

**RESPONSES TO U.S. EPA CONDITIONS (CONDITIONAL APPROVAL LETTER DATED JULY 2, 2010)  
ON THE POLYCHLORINATED BIPHENYLS NOTIFICATION PLAN**

Former Pechiney Cast Plate, Inc. Facility  
3200 Fruitland Avenue  
Vernon, California

CONDITION	RESPONSE
<p><b>2. Update site-specific sampling and analysis plan.</b> Within 15 days after the date of this approval, Pechiney shall submit for USEPA approval an updated sampling and analysis plan for soils, concert, and asphalt. The plan shall consolidate the sampling proposed in the Application and in Amendments 1, 2, and 3 and shall include the rational for the number and types of samples to be collected for both additional PCB site-characterization and PCB-cleanup verification. The sampling plan shall utilize the “EPA Region 1 Standard Operating Procedure for Sampling Porous Surfaces for PCBs (EPA SOP) to collect concrete samples. USEPA Analytical Method 1668-B shall be consulted to verify the sample collection method in the EPA SOP is appropriate to collect samples for dioxin-like congeners.</p> <p><b>C.3. Onsite disposal of onsite PCB-contaminated concrete and soils.</b> Pechiney shall complete the additional soil and concrete characterization sampling proposed in the Amended Application with 45-days after the date of this conditional approval.</p> <p><b>C.5. Amendment 2 to the Application.</b> Additional proposed concrete and soil sampling for PCB Aroclor and PCB congener analysis. Pechiney shall conduct the additional soil and concrete characterization sampling and laboratory analysis proposed in the Amended 2 (“Proposed Concrete and Soil Sampling Plan or Coplanar Polychlorinated Biphenyls Former Pechiney Cast Plate Facility”, April 2, 2010) as modified by the conditions of approval established.....<i>[in the July 2, 2010 letter]</i>.</p> <p><b>C.6. Amendment 3 to the Application.</b> Additional proposed concrete sampling for PCB Aroclor analysis. Pechiney shall conduct the additional concrete sampling and laboratory analysis proposed in the Amended 3 (“Proposed Additional Concrete Sampling Plan for Polychlorinated Biphenyls Former Pechiney Cast Plate Facility”, April 2, 2010) as modified by the conditions of approval established...<i>[in the July 2, 2010 letter]</i>.</p>	<p>To meet the Sampling and Analysis Plan (SAP) condition outlined in the July 2, 2010 conditional approval letter, an extension request was submitted to U.S. EPA for the submittal of the SAP on July 16, 2010. The SAP was submitted to U.S. EPA on July 27, 2010. U.S. EPA was notified on August 13, 2010, that the compliance dates outlined in the Conditional Approval letter would be delayed and that the sampling proposed in the SAP would be deferred pending U.S. EPA’s approval of the SAP. U.S. EPA approved the SAP with modifications on August 30, 2010. These modifications included 1) the requirement to use EPA Method 3540C (Soxhlet Extraction) for samples extracted for the analysis of PCBs by EPA Method 8082 (latest version); 2) that concrete samples must be properly crushed prior to extraction; 3) methods for maintaining low detection limits; and 4) requesting the field quality assurance/quality control (QA/QC) procedures for the collection of concrete and soil samples. A summary of the field QA/QC procedures were submitted to U.S. EPA on September 3, 2010.</p> <p>The sampling covered under Section 2.1 (Amendment 3), Section 2.2 (Amendment 2), and Section 2.3 (Application) of the SAP was conducted between September 9, 2010 and October 18, 2010, with final laboratory analytical data received on November 8, 2010. A summary of the soil and concrete Aroclor results are provided in Tables 1 and 2 of Attachment 1; the soil and concrete dioxin-like PCB congener results are provided in Tables 3 and 4 of Attachment 1. Figures depicting the sampling locations also are provided in Attachment 1 as Figures 1, 2a, and 2b.</p>
<p><b>C.3.a. Cumulative health risk evaluation to include dioxin-like PCB congeners.</b> Within 30 days after completion of the additional site characterization (including PCB RAP and Amendments 1, 2, and 3 to the Application) for PCBs (Aroclors and PCB congeners) required under this approval, Pechiney shall demonstrate the cumulative health risk from the site addressing all contaminants of concern does not increase above <math>1 \times 10^{-5}</math>. Due to the age of the releases at the site, dioxin-like PCB congeners (i.e., PCB congeners) may be present in onsite concrete and soils and are, therefore, added to the contaminants of concern. If PCB congeners are detected in onsite concrete and / or soils, Pechiney must demonstrate the PCB congener levels do not increase the overall cumulative risk for the site above <math>1 \times 10^{-5}</math>. If this risk level is exceeded, Pechiney must propose for USEPA approval cleanup levels for PCBs in concrete and soils that do not pose a risk of injury to health or the environment.</p>	<p>Additional soil and concrete characterization for dioxin-like PCB congeners was completed in September and October, 2010. This work was conducted following the procedures described in Section 2.2 of the SAP (Amendment 2 to the PCB Notification Plan). A summary of the soil and concrete dioxin-like PCB congener results are provided in Tables 3 and 4 of Attachment 1. To determine whether or not the dioxin-like PCB congeners at the Site may contribute more significantly to overall cumulative risk for the Pechiney site than PCBs as Aroclor mixtures, regression analyses and human health risk calculations were performed with the pairs of dioxin-like PCB congener and Aroclor mixture data from the 2010 concrete and soil samples. The methodologies and results of these evaluations are presented in Attachment 1. As presented, potential human health risks from dioxin-like PCB congeners (as dioxin TEQ) are slightly more significant than potential human health risks from total Aroclors, and a slight reduction of the site-specific, risk-based remediation goals for PCBs as total Aroclors would be necessary to be adequately protective of PCBs as dioxin-like congeners. Specifically, the following revised remediation goals for PCBs (as total Aroclors) are proposed: 1) 3.5 mg/kg for total Aroclors in concrete or soil that may be left exposed at the surface; and 2) 23 mg/kg for total Aroclors in soil to be left below pavement or other ground cover that only construction workers may come into contact with during construction (or 5 feet below crushed concrete containing less than 3.5 mg/kg).</p>

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<p><b>C.3.b. Grading plan for the Pechiney site before remediation.</b> Within 45 days after the date when Pechiney completes the additional site characterization required in this approval, Pechiney shall submit for USEPA review and concurrence, the grading plan for the site. In general, the site-specific grading plan shall:</p> <ol style="list-style-type: none"> <li>1. Identify the location, depth, and PCB concentration (Aroclors and PCB congeners) of all onsite soils proposed for onsite disposal relative to the location and depth of soils that may get disturbed during grading of the site and relative to onsite soils containing total PCB concentrations below the approved PCB cleanup level.</li> <li>2. Be informed by the results of additional soil and concrete characterization required at the site and described in the Amended Application. See Condition 3a above.</li> <li>3. Identify the locations for onsite disposal of crushed concrete with PCB concentrations below the approved cleanup level relative to the location of soils contaminated with PCBs above the cleanup level and soils contaminated with solvents (e.g., volatile organic compounds, total petroleum hydrocarbons, Stoddard solvent).</li> <li>4. Demonstrate that during grading operations PCB contaminated soils located below 5 feet bgs (or at a depth modified by USEPA) and containing PCBs equal to or above the approved cleanup level will not be disturbed and mixed with onsite soils and crushed concrete containing less than the approved cleanup level and less than 1 ppm PCBs.</li> <li>5. Include the measures that Pechiney will take to prevent spread of PCBs at and above the approved cleanup level throughout or at specific locations at the site if the soil mixing mentioned in Item 4 above occurs.</li> <li>6. Identify the location of any proposed underground physical barriers that Pechiney may install before grading the site and that are intended to alert others that onsite soils containing high PCB concentrations (e.g., 2,000 ppm) have been disposed onsite.</li> </ol>	<p>The grading plan cannot be finalized until the remediation goals for concrete and soil are approved by U.S. EPA. Remediation goals for soil and concrete will determine the cut and fill quantities of these materials that will remain on site; which will need to be incorporated into the proposed final grading plan. A preliminary grading plan based on the site-specific remediation goals for PCBs in soil or crushed concrete will be provided under separate cover for informational purposes. The final grading plan will be submitted to U.S. EPA after its approval of the remediation goals.</p>
<p><b>C.3.c. Soils management plan after remediation.</b> Within 30 days after Pechiney completes remediation of the site, Pechiney shall submit for review and USEPA approval a post-remediation soil management plan. The plan must describe all the actions that will be taken to ensure proper management and disposal of PCB-contaminated soils, PCB-contaminated concrete, PCB-contaminated asphalt if such materials are encountered during grading, construction, and installation of underground utilities; and after redevelopment, if such materials are encountered during maintenance or repair of underground structures (e.g., utilities) at the site above the PCB cleanup levels approved by USEPA. Such soils, concrete, and / or asphalt must be removed from the site if encountered at the surface and / or at depths that USEPA determines may result in an unreasonable risk of injury to health or the environment.</p>	<p>This document will be provided to U.S. EPA 30 days after the completion of the below grade demolition and soil excavation work.</p>

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<p><b>C.3.d. Revised Appendix C before remediation.</b> Within 45 days after Pechiney completes the additional site characterization required in this approval, Pechiney must submit a revised Appendix C (Site-Specific Modeling for the Protection of Groundwater).</p> <p>1) Rainfall totals that were used were based on an average rainfall year of 14.8 inches (1914-2007) of which a 25% infiltration rate of approximately 4 inches was used. Since the model was run over a period of 500 years and in order to simulate a more conservative worst case, a suggested 250-500 year recurrence interval for rainfall would be more realistic. In addition, short duration, high intensity rainfall events shall be considered. Can the model simulate 24-hour rainfall events such as 100, 250, 500 year 24-hour recurrence intervals that would produce wetting fronts capable of transporting PCBs?</p> <p>2) In addition, solvents are indicated as being present in the soils around the facility. Have solvents been considered in the mobility and transport of PCBs in soils under both saturated and unsaturated conditions? Can the models factor in the effects of solvents on the mobility of PCBs?</p> <p>3) The revised Appendix C shall be responsive to the questions. The revised Appendix C shall evaluate the potential for PCBs to migrate from crushed concrete when such material is disposed in onsite areas where soils are contaminated with solvents (e.g., chlorinated hydrocarbons, Stoddard solvent, total petroleum hydrocarbons). Appendix C shall explain the fate and transport mechanism involved in the migration of PCBs at depths well below 15 feet bgs. PCBs have been detected at 71 feet bgs (e.g., 0.490 mg / kg).</p> <p>4) In addition, the revised Appendix C shall indicate the particle size used in the model for the crushed PCB-contaminated concrete proposed for onsite disposal.</p>	<p>Responses to U.S. EPA's questions are summarized below.</p> <p><b><u>Response to the first question (1):</u></b></p> <p>It would be inappropriate to base the infiltration rate on rainfall with long recurrence intervals such as 250 or 500 years, because it would be unrealistic for rainfall with such recurrence intervals to persist over a period of 500 years. The objective of the site-specific modeling is to evaluate the long-term impacts to groundwater by PCBs in soil and concrete disposed on-site, which requires the use of an infiltration rate that corresponds to long-term average rainfall, instead of extreme events.</p> <p>In addition, annual rainfall with 250 to 500 year recurrent intervals cannot be estimated, because only 100 years of rainfall data (from 1906 to 2009) are available at the nearby weather station (Los Angeles Civic Center).<sup>1</sup> Although annual rainfall with a 100-year recurrence interval can be estimated as 34 inches per year, even this estimate contains a fair amount of uncertainty because only 100 years of data are available.</p> <p>Sufficient conservativeness has been built into the infiltration rate of 4 inches per year used in the site-specific modeling. First, because the final ground surface will be either paved or vegetated and graded to facilitate runoff, the assumed 25 percent of rainfall as infiltration is a conservative assumption. Second, the assumed infiltration rate of 4 inches per year is higher than estimates from other published studies (see Section 2.0 of the attached Appendix C).</p>

<sup>1</sup> Western Regional Climate Center, <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca5115>

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	<p>Short duration, high intensity rainfall events, such as 24-hour rainfall with a 100-year recurrence interval, are not expected to substantially impact the downward transport of PCBs through the unsaturated zone. First, during short duration, high intensity rainfall events, infiltration rates would not increase in proportion to rainfall. Most of the rainfall would become runoff because of quick soil saturation near the ground surface. In fact, peak runoff during short duration, high intensity rainfall events often drives storm water drainage design. Therefore, infiltration rates during short duration, high intensity rainfall events would not be substantially higher than average infiltration rates. Second, the highest 24-hour rainfall at the nearby weather station between 1906 and 2009 is 5.5 inches, which only translates into a few inches of wetting front movement. Finally, the low mobility of PCBs is mainly a result of their propensity of absorbing to organic matters in the subsurface, as exemplified by their high sorption partition coefficients. For example, a study on a PCB-spill site in Canada concluded that downward flow velocity of dissolved PCBs is likely on the order of millimeters per year (Schwartz et al., 1982).<sup>2</sup> Having higher than average infiltration rates over a handful of days during a 500-year period is not expected to substantially increase the velocity of dissolved PCBs. Therefore, it is unnecessary to simulate extreme rainfall events in the site-specific modeling.</p> <p>Nevertheless, to add another level of conservativeness in the site-specific modeling, we revised the infiltration rates so that they consist of five 100-year cycles. Each 100-year cycle is comprised of 99 years with an infiltration rate based on average rainfall (i.e., 4 inches per year) and one year with an infiltration rate based on the rainfall with a 100-year recurrence interval (i.e., 8.5 inches per year). These modifications did not change the results or conclusions of the site-specific modeling.</p> <p><b><u>Response to the second question (2):</u></b></p> <p>The site-specific modeling does not include effects of solvents, such as chlorinated hydrocarbons, Stoddard solvent, and total petroleum hydrocarbons, on the mobility of PCBs under saturated or unsaturated conditions because of the lack of quantitative relationships between sorption partition coefficients (or solubility) of PCBs and co-solvent concentrations even in state-of-the-art modeling programs such as MODFLOW-SURFACT. Research has shown that sorption of hydrophobic organic chemicals (HOCs) such as PCBs can decrease in the presence of some solvents, but that the co-solvent effects are measurable (observable) only under two conditions, neither of which occurs at the Site:</p> <ul style="list-style-type: none"><li>a. When the solvents are completely miscible with water; or</li><li>b. When polar, partially miscible organic solvents are present in concentrations on the order of a few percents by volume (free product).</li></ul>

<sup>2</sup> Schwartz, F.W., J.A. Cherry, and J.R. Roberts, 1982, A case study of a chemical spill: polychlorinated biphenyls (PCBs), 2, Hydrogeological conditions and contaminant migration, Water Resource Research, 18, 535-545.

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	<p>Furthermore, the co-solvents that are neither polar nor completely miscible in water, such as trichloroethene, toluene, and p-xylene, have little effect on the sorption of HOCs (Haasbeek, 1994; Rao et al., 1990; Pinal et al., 1990).<sup>3,4,5</sup> Because most of the solvent-related chemicals in soil at the Site belong to the group of nonpolar, partially miscible organic solvents and exist at relatively low concentrations (i.e., far less than a few percents by volume), these chemicals are not expected to have a substantial impact on the migration of PCBs from crushed concrete. Therefore, the effects from residual solvents in soil are not considered in the site-specific modeling.</p> <p><b><u>Response to the third question (3):</u></b></p> <p>The location where PCBs were detected at a depth of 71.5 feet at a concentration of 0.490 mg/kg was observed at one boring advanced near a former vertical pit that contained a hydraulic ram. The hydraulic ram extended to a depth of 65 feet and steel sheet piling for the vertical pit extended to a depth of 47 feet. In this case, the PCBs detected at depth below 15 feet bgs are believed to be associated with the historical operation of the former hydraulic ram within the pit (proposed soil removal Area 4a in former Building 104). The vertical pit was decommissioned in place in the 1970's by Alcoa. As part of the below grade demolition work, the upper 10 feet of the structure will be removed and the remaining portion of the structure will be capped with concrete. Therefore, this preferential pathway for PCBs to migrate below 15 feet bgs no longer exists.</p> <p>In addition, PCB-impacted soil is proposed for removal to a depth of 15 feet in Area 4a/4b (area where PCBs were detected at 71.5 feet as noted above). Once soil is removed, a concrete layer will be placed at the base of the soil excavation prior to backfill.</p> <p><b><u>Response to the fourth question (4):</u></b></p> <p>Particle size is not a parameter in the model. In the original model simulations, the hydrogeologic and Van Genuchten's parameter values for sand from the ROSETTA program were used to approximate the properties of crushed concrete. The ROSETTA program uses USDA soil textual classes or percentages of sand, silt, and clay, rather than particle sizes, as input parameters.</p> <p>Based on the project engineering specifications, the crushed concrete will be well graded with a particle size of 1 ½-inch or ¾-inch. Therefore, the model for crushed concrete was revised to use the hydrogeologic and Van Genuchten's parameter values for gravel (Fayer et al., 1992)<sup>6</sup>. It should be noted that the downward water flux and PCB migration are limited by the least permeable soil types in the unsaturated zone. Therefore, using either gravel or sand properties will not result in a substantial change to simulation results.</p> <p>Using the gravel instead of sand properties to represent crushed concrete did not change the results and conclusions of the site-specific modeling.</p> <p>In summary, the changes made to the model to address EPA's comments did not change the results or conclusions of the site-specific modeling. Therefore, PCBs in soil at the site and PCBs in concrete that may be re-used (on-site disposal) as on-site fill materials do not pose a potential threat to groundwater at the site. A revised version of Appendix C is attached.</p>

<sup>3</sup> Haasbeek, J.F., 1994, Effects of Cosolvency in the Fate and Transport of PCBs in Soil, Remediation, Summer.

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<p><b>C.3.e. Interim cap.</b> Within 60 to 90 days after the date of this approval or within 15 days after completing cleanup verification sampling, whichever occurs first, Pechiney shall provide a figure to scale depicting the interim cap to be installed at the Pechiney site atop crushed onsite concrete containing PCBs below the approved cleanup level for surface and shallow soils. The figure shall identify the type and thickness of material that will function as an interim cap. The PCB concentration in the cap material shall be below 1 ppm PCBs. The interim cap shall not allow infiltration of water. Although the site is fenced, it is not certain when the site will be redeveloped and the specific industrial / commercial uses for the site have not been finalized.</p> <p><b><u>Pechiney's Proposed Cap</u></b></p> <p>Pechiney has proposed to add a color dye to the waste concrete with PCBs below 5.3 ppm to be disposed onsite within 0 to 5 feet bgs and to place atop that waste crushed onsite-concrete containing PCBs below 1 ppm. If USEPA approves the PCB cleanup levels that Pechiney proposed for concrete and soils, USEPA may consider the proposed cap if (1) a material (e.g., a layer of asphalt) that could prevent water infiltration is placed atop the crushed concrete containing PCBs below 1 ppm, (2) information is provided to USEPA demonstrating no adverse impacts to the environment are expected from the dyes Pechiney proposes to use, and (3) the interim cap is placed after site grading is completed. In addition, Pechiney needs to provide the figure to scale depicting the interim cap requested in this Condition of approval.</p>	<p>A proposed interim cap figure was submitted by e-mail correspondence to U.S. EPA on October 1, 2010 in which the proposed approach for the interim cap was as follows:</p> <ul style="list-style-type: none"> <li>• Placement of an interim cap consisting of a minimum 25-centimeter thick layer of crushed onsite concrete containing PCBs at concentrations less than 1 ppm (&lt;1 ppm) over only those localized areas that have been backfilled with crushed onsite concrete containing PCBs at concentration greater than 1 ppm (&gt;1 ppm) but less than the proposed site-specific remediation goal or where soil remains at the native soil surface with PCBs &gt;1 ppm but less than the proposed site-specific remediation goal.</li> <li>• This interim cap would consist of a reduced infiltration layer comprised of compacted crushed concrete containing PCBs at a concentration &lt;1 ppm. The cap would be constructed with sloped upper surfaces to promote drainage to a best management practice (BMP) controlled storm water collection area as opposed to allowing ponding and infiltration to occur.</li> <li>• Crushed concrete containing PCBs at concentrations &lt;1 ppm are also proposed for use during site grading as unrestricted fill materials without the placement of an interim cap of any type over these materials.</li> </ul> <p>A revised conceptual figure depicting the proposed interim cap and the thickness of the materials that would underlie the proposed interim cap is attached.</p> <p>We have also considered other options for the colorant dye marker. Rather than using a dye to demarcate the uppermost surface of the area where on-site crushed concrete containing PCBs at concentration &gt;1 ppm and less than the proposed site-specific remediation goal is placed, we are proposing to use an HDPE brightly colored mesh identifier layer. Details of the HDPE material are shown on the attached Figure 9.</p>

<sup>4</sup> Rao, P.S.C., L.S. Lee, and R. Pinal, 1990, Cosolvency and Sorption of Hydrophobic Organic Chemicals, Environmental Science & Technology, 24, 647-654

<sup>5</sup> Pinal, R., P.S.C. Rao, L.S. Lee, and P.V. Cline, 1990, Cosolvency of Partially Miscible Organic Solvents on the Solubility of Hydrophobic Organic Chemicals, 24, 639-647.

<sup>6</sup> Fayer, M. J., M. L. Rockhold, and M. D. Campbell, 1992, Hydrologic Modeling of Protective Barriers: Comparison of Field Data and Simulation Results, Soil Science Society of America Journal, 56: 690-700.

## **ATTACHMENT 1**

### **IMPACT OF ADDITIONAL SOIL AND CONCRETE CHARACTERIZATION ON RISK-BASED REMEDIATION GOALS**

As part of the U. S. Environmental Protection Agency's (U.S. EPA's) conditional approval (U.S. EPA, 2010a) of the Polychlorinated Biphenyl (PCB) Notification Plan (AMEC, 2009a), U.S. EPA deferred approval of proposed remediation goals for PCBs in soil and concrete at the former Pechiney Cast Plate facility (the Site) until Pechiney could demonstrate that dioxin-like PCB congeners, if present in onsite concrete and/or soil, do not increase the cumulative cancer risk for the Site above  $1 \times 10^{-5}$ . If this risk level were exceeded, it was required that Pechiney propose, for U.S. EPA's approval, cleanup levels for PCBs in concrete and soil that are adequately protective and do not pose a risk of injury to health or the environment. Based on this requirement, the additional sampling outlined in Section 2.2 of the Sampling and Analysis Plan (SAP) (AMEC, 2010) was conducted in September and October, 2010, and the sampling results were evaluated for potential human health concerns. The findings of this additional investigation are presented below.

#### **1.0 SUMMARY OF POTENTIAL HUMAN HEALTH RISKS AND PCB REMEDIATION GOALS PRESENTED IN THE PCB NOTIFICATION PLAN**

Potential human health risks associated with hypothetical exposures to PCBs in soil and concrete at the Site were originally estimated in the PCB Notification Plan (AMEC, 2009a), and subsequently in the Feasibility Study (FS) within the context of cumulative exposures to all chemicals of potential concern (COPCs) at the Site (AMEC, 2009b). Potential human health risks were evaluated separately for soil and concrete for each "Phase area" of the Site, assuming concrete building slabs may be demolished on site, crushed, and reused as fill in soil and foundation removal areas. Based on the maximum detected concentrations of PCBs (as Aroclors) in soil (between 0 to 15 feet below ground surface [bgs]) and concrete, and risk-based screening levels (RBSLs) protective of potential direct contact exposures, predicted cancer risks and noncancer hazard indexes (HIs) for potential exposures to PCBs were above target levels ( $10^{-5}$  cancer risk and a noncancer HI of 1) for hypothetical future worker outdoor commercial/ industrial workers and construction workers in the Phase I, II, and IIIa areas (AMEC, 2009a) as summarized on the next page.

Area	Potential Exposures to PCBs in Soil			Potential Exposures to PCBs in Concrete	
	Predicted Cancer Risks > $1 \times 10^{-5}$		Predicted Noncancer HIs > 1	Predicted Cancer Risks > $1 \times 10^{-5}$	
	Outdoor Commercial/ Industrial Worker	Construction Worker	Construction Worker	Outdoor Commercial/ Industrial Worker	Construction Worker
Phase I	$8 \times 10^{-5}$	- <sup>1</sup>	-	$3 \times 10^{-4}$	$4 \times 10^{-5}$
Phase II	$2 \times 10^{-3}$	$3 \times 10^{-4}$	-	$6 \times 10^{-3}$	$1 \times 10^{-3}$
Phase IIIa	$2 \times 10^{-5}$	-	3	-	-

Note:

1. = the predicted cancer risk did not exceed  $10^{-5}$  or the noncancer HI did not exceed 1.

Carcinogenic PCBs were detected in soil and concrete in other Phase areas of the Site (in soil in the Phase IV and Phase VI areas and in concrete in the Phase IV area), but predicted cancer risks from PCB exposures were well below  $10^{-5}$ . Predicted cancer risks for cumulative exposures to COPCs in soil in the Phase IV and VI areas were above  $10^{-5}$  for certain receptors, but potential exposures to PCBs contributed minimally to these cumulative risks. Specifically,

- a cumulative cancer risk of  $1 \times 10^{-4}$  was estimated for outdoor commercial/industrial workers in the Phase IV area, of which potential exposures to PCBs in soil contributed  $4 \times 10^{-6}$ ;
- a cumulative cancer risk of  $2 \times 10^{-5}$  was estimated for construction workers in the Phase IV area, of which potential exposures to PCBs in soil contributed  $6 \times 10^{-7}$ ; and
- a cumulative cancer risk of  $6 \times 10^{-5}$  was estimated for outdoor commercial/industrial workers in the Phase VI area, of which potential exposures to PCBs in soil contributed  $1 \times 10^{-6}$  (AMEC, 2009b).

Potential exposure to arsenic contributed the majority of the cancer risk in these two areas.

Based on the risk assessment results for the Phase I, Phase II, and Phase IIIa areas of the Site summarized above, site-specific remediation goals were proposed for PCBs to mitigate potential direct contact exposures to future workers (AMEC, 2009a, 2009b).

1. Proposed Remediation Goals for PCBs in Concrete
  - a. **Total Aroclors – 5.3 milligram per kilogram (mg/kg).** Based on the carcinogenic RBSL for outdoor commercial/industrial workers (0.53 mg/kg), adjusted to a target cancer risk of  $10^{-5}$ .<sup>1</sup>
2. Proposed Remediation Goals for PCBs in Shallow Soil (0 to 15 feet bgs)
  - a. **Aroclor-1254 – 2.0 mg/kg.** Based on the noncancer RBSL for Aroclor-1254 for construction workers and a target noncancer HI of 1.<sup>2</sup>
  - b. **Total Aroclors – 5.3 mg/kg.** For soil that may be left exposed at the surface (upper 5 feet). Based on the carcinogenic RBSL for outdoor commercial/industrial workers (0.53 mg/kg), adjusted to a target cancer risk of  $10^{-5}$ .
  - c. **Total Aroclors – 35 mg/kg.** For soil to be left below pavement or other ground cover that only construction workers may come into contact with during construction (or 5 feet below crushed concrete containing less than 5.3 mg/kg). Based on the carcinogenic RBSL for construction workers (3.5 mg/kg), adjusted to a target cancer risk of  $10^{-5}$ .

Additional remediation goals were proposed for arsenic and total petroleum hydrocarbons (TPH) in soil (AMEC, 2009b). However, given the nature of these additional remediation goals, which were not based on potential direct contact exposures (for arsenic, a remediation goal corresponding to site-specific background was proposed; for TPH, remediation goals were proposed for the protection of groundwater, which were lower than concentrations protective of construction worker exposures), the proposed remediation goals for PCBs were considered adequately protective within the context of cumulative exposures at the Site.

## 2.0 ADDITIONAL INVESTIGATION

Following U.S. EPA's review of the PCB Notification Plan, the U.S. EPA deferred approval of the proposed remediation goals until after additional information was provided, including additional soil and concrete characterization for PCBs (U.S. EPA, 2010a). An additional 82 concrete samples and 65 soil samples were collected in September and October, 2010, and analyzed for PCBs as Aroclor mixtures using U.S. EPA Method 8082. Of these, nine of the concrete samples and 17 of the soil samples were "split" for additional analysis by U.S. EPA

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<sup>1</sup> Total Aroclors are the sum of Aroclor mixtures. As all Aroclor mixtures were considered potential carcinogens with the same degree of cancer potency, the remediation goals were proposed to address cumulative potential cancer risks.

<sup>2</sup> Of the Aroclor mixtures detected at the Site, only Aroclor-1254 has been identified as a potential noncarcinogen. A potential carcinogen as well, Aroclor-1254 is also included in estimations of Total Aroclors.

Method 1668B for individual “dioxin-like” PCB congeners.<sup>3</sup> The additional congener-specific analyses were performed to address a concern from the U.S. EPA that, based on the age of the facility and the historical manufacturing operations, dioxin-like PCB congeners may be present at the Site at more significant concentrations, in terms of potential human health risk, than PCBs as Aroclor mixtures, and that the remediation goals proposed for total Aroclors in the PCB Notification Plan may, therefore, not be adequately protective. The samples selected for both analyses were not collected at random, rather from areas where total Aroclors were reported from previous rounds of sampling at high, medium, and low concentrations with respect to the proposed 5.3 mg/kg risk-based remediation goal, with the majority of the samples intentionally collected from locations where total Aroclors were just below the remediation goal (within one order of magnitude). Specific information regarding the targeted sample locations and sampling procedures is provided in Amendment 2 to the PCB Notification Plan and Section 2.2 of the SAP. The intent of the targeted sampling was to provide coverage across a range of concentrations so that potential correlations between PCBs as Aroclors and the dioxin-like PCB congeners could be evaluated. An established correlation between PCBs as Aroclors and the dioxin-like PCB congeners could be used to 1) potentially estimate dioxin toxic equivalent (TEQ) concentrations associated with previous sampling results, 2) support (or refine) the site-specific PCB remediation goals, and 3) support remediation confirmation sampling.

## **2.1 ANALYTICAL RESULTS OF ADDITIONAL CONCRETE AND SOIL SAMPLES**

The results of the additional concrete and soil sampling are provided in Tables 1 through 4, and are depicted on Figures 1 and 2a/2b. The 2010 characterization results for Aroclor mixtures (U.S. EPA Method 8082) in the concrete samples are presented in Table 1. Similarly, the 2010 characterization results for Aroclor mixtures in the soil samples are presented in Table 2. The concrete and soil results are presented by location on Figures 1 and 2, respectively. Consistent with earlier characterization sampling events, the primary mixture of PCBs detected in the 2010 concrete and soil samples was Aroclor-1248, and to a lesser extent, Aroclor-1254 and Aroclor-1260. Aroclor-1232 was detected in one soil sample and Aroclor-1016, previously not detected in concrete or soil, was detected in four concrete samples and two shallow soil samples (0 to 15 feet bgs).

The 2010 results for dioxin-like PCB congeners in the concrete and soil samples targeted for this additional analysis are presented in Tables 3 and 4, respectively. As presented in these tables, all 12 dioxin-like PCB congeners were detected at least once in both concrete and soil. In both sample sets, PCB 118 was consistently detected at the highest concentrations, followed

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<sup>3</sup> Concrete samples were split by first milling each sample to a powder/fine granular mixture, then homogenizing the sample, then dividing the sample into two aliquots. Soil samples were split by manually (mechanically) blending each sample and then dividing into two aliquots.

by PCB 105. However, to put the detected concentrations of dioxin-like PCB congeners into toxicological perspective, dioxin TEQ concentrations were calculated for each sample. Dioxin TEQ concentrations were calculated using the toxic equivalency factors (TEFs) developed by the World Health Organization (WHO) in 2005 (Van den Berg, M. et al., 2006). Where the concentration of an individual dioxin-like PCB congener was reported as not detected, one half of the detection limit was used as a surrogate to calculate the contribution to dioxin TEQ concentrations from that congener. Of the two commonly used approaches to calculating a dioxin TEQ,<sup>4</sup> using one half of the detection limit for non-detect results was considered appropriate for the 2010 concrete and soil data given that all 12 dioxin-like PCB congeners were detected at least once in both data sets, thus providing evidence that all 12 congeners were present at the Site. Dioxin TEQ concentrations for PCB congeners ranged from 2.81 to 14,250 picograms per gram (pg/g) in concrete (Table 3) and 0.14 to 573 pg/g in soil (Table 4). The estimated dioxin TEQ concentrations for the concrete and soil samples are presented by location on Figures 1 and 2a/2b, respectively.

### **3.0 RISK-BASED SCREENING LEVELS FOR DIOXIN-LIKE PCB CONGENERS AND AROCLOR-1016**

RBSLs were developed for dioxin-like PCB congeners following the methodology described in the PCB Notification Plan (AMEC, 2009a). RBSLs were also developed for Aroclor-1016 since this Aroclor mixture had not been previously detected in earlier sampling. The exposure parameters used in deriving the RBSLs are provided in Tables 5 and 6 for outdoor commercial/industrial workers and construction workers, respectively. Toxicity criteria selected for use in developing the RBSLs for Aroclor-1016 and dioxin-like PCB congeners were obtained from the California Environmental Protection Agency (Cal-EPA) Office of Environmental Health Hazard Assessment (OEHHA) (2010) and the U.S. EPA (2010b, 2010c). The resulting RBSLs for Aroclor-1016 and dioxin-like PCB congeners are presented in Table 7 and are summarized on the next page along with the RBSLs originally estimated in the PCB Notification Plan for Aroclor-1232, Aroclor-1248, Aroclor-1254, and Aroclor-1260 (AMEC, 2009a).

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<sup>4</sup> The alternative approach to calculating dioxin TEQ is to assume that non-detect congeners are not present and thus contribute zero to dioxin TEQ concentrations.

Chemical	RISK-BASED SCREENING LEVELS (RBSLs)			
	Outdoor Commercial/Industrial Worker		Construction Worker	
	Cancer	Noncancer	Cancer	Noncancer
<i>Aroclors</i>				
Aroclor-1016 (mg/kg)	0.53	26	3.5	6.9
Aroclor-1232 (mg/kg)	0.53	--	3.5	--
Aroclor-1248 (mg/kg)	0.53	--	3.5	--
Aroclor-1254 (mg/kg)	0.53	7.5	3.5	2.0
Aroclor-1260 (mg/kg)	0.53	--	3.5	--
<i>Dioxin-like PCB Congeners</i>				
PCB 77 (pg/g)	81,000	3,800,000	500,000	1,000,000
PCB 81 (pg/g)	27,000	1,300,000	180,000	340,000
PCB 105 (pg/g)	270,000	13,000,000	1,800,000	3,400,000
PCB 114 (pg/g)	270,000	13,000,000	1,800,000	3,400,000
PCB 118 (pg/g)	270,000	13,000,000	1,800,000	3,400,000
PCB 123 (pg/g)	270,000	13,000,000	1,800,000	3,400,000
PCB 126 (pg/g)	81	3,800	530	1,000
PCB 156, 157 (pg/g)	270,000	13,000,000	1,800,000	3,400,000
PCB 167 (pg/g)	270,000	13,000,000	1,800,000	3,400,000
PCB 169 (pg/g)	270	13,000	1,800	3,400
PCB 189 (pg/g)	270,000	13,000,000	1,800,000	3,400,000
Dioxin-like PCB congeners (pg/g TEQ)	8.1	380	53	100

The detected concentrations of Aroclor-1016 in the 2010 concrete samples (maximum detected concentration of 0.32 mg/kg; Table 1) and soil samples (maximum detected concentration of 0.25 mg/kg; Table 2) are below the estimated RBSLs for outdoor commercial/industrial workers and construction workers. As a result, Aroclor-1016 in concrete or soil does not pose a potential health risk to future workers at the Site. Within the context of cumulative exposures and proposed risk-based remediation for total Aroclors, the maximum total Aroclor concentrations in the samples with detected concentrations of Aroclor-1016 are 0.53 mg/kg in concrete (Sample ID DC-235-A; Table 1), and 0.25 mg/kg in shallow soil (Sample ID 203-SS-01; Table 2), both of which are well within the proposed 5.3 mg/kg remediation goal for total Aroclors in concrete or shallow soil.

#### **4.0 POTENTIAL HUMAN HEALTH RISKS FROM DIOXIN-LIKE PCB CONGENERS VERSUS PCBs AS AROCLOR MIXTURES**

For dioxin-like PCB congeners, the potential human health concern pertains to whether or not these congeners present a more significant human health risk than PCBs as Aroclor mixtures. To evaluate this potential concern, regression analyses and human health risk calculations were performed with the pairs of dioxin-like PCB congener and Aroclor mixture data from the 2010 concrete and soil samples.

##### **4.1 REGRESSION ANALYSES OF DIOXIN TEQ VERSUS TOTAL AROCLORS**

Regression analyses were performed with the pairs of dioxin-like PCB congener and Aroclor mixture data to evaluate the potential significance of the relationship between these measurements and determine whether the proposed risk-based remediation goals are adequately protective of potential PCB exposures. Dioxin TEQ and total Aroclor concentrations for the 2010 concrete and soil samples were plotted against each other as representative variables for the dioxin-like PCB congeners and Aroclor mixtures, respectively. The results of this analysis are provided below.

Separate regression analyses were performed for the concrete samples, soil samples, and concrete and soil samples combined. Each regression was made as dioxin TEQ (y-axis) versus total Aroclors (x-axis). For consistency with the treatment of non-detect congeners in the estimation of dioxin TEQ, one half of the reporting limit for non-detect Aroclor mixtures was used in the calculation of total Aroclors, with results for Aroclors 1016, 1232, 1248, 1254, and 1260 factoring into the total Aroclor concentration calculations.

The data from each sample point were originally plotted by characteristic (i.e., by Phase area and soil sample depth), but no segregation by characteristic was observed. This indicated that

there was no basis to perform statistical regressions on separate subsets of concrete or soil samples. Next, linear regressions were performed for the concrete data, soil data, and concrete and soil data combined using the Regression function in Microsoft EXCEL. In these regressions, the line was forced to pass through the origin (the 0,0 point), resulting in a linear equation in the form,  $y = mx$ , where  $m$  is a constant. The 95 percent upper confidence limit (95% UCL) and the 95 percent lower confidence limit (95% LCL) for each regression line were also provided by the Regression function in Microsoft EXCEL, providing upper- and lower-bound estimates, respectively, of the slope ( $m$ ) of each regression line (i.e., there is less than a 5 percent chance that the true slope of the regression is steeper than the UCL and there is less than a 5 percent chance that the true slope of the regression is less steep than the LCL). Combined, the slope of each regression line represents the best estimate of the relationship between dioxin TEQ and total Aroclor concentrations (i.e., the ratio of dioxin TEQ to total Aroclor concentration) for each data set, with the 95% UCL and 95% LCL representing upper- and lower-bound estimates, respectively, of the relationship (ratio) for the data set. These procedures were performed using each data set in an untransformed state (i.e., no logarithmic or other form of transformation was performed on the data prior to the procedures).

The results of the regressions for the untransformed data sets are depicted on Figures 3, 4, and 5 for the concrete data, soil data, and concrete and soil data combined, respectively. As shown in each figure, the results of the regressions were plotted against the proposed risk-based remediation goal for PCBs in concrete and soil that may be left exposed at the surface (upper 5 feet) of 5.3 mg/kg total Aroclors (represented by the black vertical line in each figure), and the equivalent risk-based remediation goal for dioxin-like PCB congeners, 81 pg/g TEQ<sup>5</sup> (represented by the black horizontal line in each figure).

The three regression analyses were repeated using log-transformed data. In this case, the data were transformed using the natural logarithm (symbolized as  $\ln$ ). The linear regression was performed on the transformed data using the Regression function in Microsoft EXCEL. In these regressions the line was not forced to pass through the origin. The resulting linear equations had the form of  $\ln(y) = m\ln(x) + b$ . The 95% UCL and 95% LCL for these linear regressions were calculated using the method described in Scheffler (1979). The results of these regressions are depicted on Figures 6, 7, and 8 for the concrete data, soil data, and concrete and soil data combined, respectively. The regressions using log-transformed data estimated two variables, the slope and intercept. Thus, the 95% UCLs and 95% LCLs for these regressions are curved lines. Furthermore, none of the regression lines in the log-transformed domain had a slope that was exactly unity (1.000), which results in curved lines in the non-transformed domain. In this

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<sup>5</sup> Based on the carcinogenic RBSL for dioxin-like PCB congeners for outdoor commercial/industrial workers (8.1 pg/g TEQ), adjusted to a target cancer risk of  $10^{-5}$ .

case, neither the regression lines derived from the transformed data nor the corresponding UCLs or LCLs can be used to estimate the ratio of dioxin TEQ to total Aroclor concentration; however, they can be used to calculate a total Aroclor concentration corresponding to a specified dioxin TEQ.<sup>6</sup>

To compare the relative strength of each regression, the F-statistic for each regression was provided by the Regression function in Microsoft EXCEL. The F-statistic is the ratio of a measure of the goodness of the fit of the regression to the data to a measure of the poorness of the fit. A larger F-statistic corresponds to a better fit of the regression to the data. The resulting F-statistics are provided, along with additional characteristics of each regression, in Table 8. The F-statistic for each of the six regressions exceeded its respective critical value of F corresponding to a significance of 5% (comparable to 95% confidence). These critical values are the minimum value of the F-statistic needed to achieve a statistical significance of 5%. That all F-statistics exceeded their respective critical values indicates high strength for all of the regressions. The statistical significance of the F-statistics for the six regressions ranged from  $2.49 \times 10^{-4}$  to  $3.33 \times 10^{-30}$  (lower values represent greater strength).

The regression with the strongest F-statistic was the regression using the untransformed combined soil and concrete data. Furthermore, this regression using untransformed data has “physical significance,” in that the slopes of the regression line, the UCL, and the LCL are estimators of the ratio between dioxin TEQ and total Aroclor concentration. As shown on Figure 5, this regression identifies a concentration of total Aroclors at the risk-based remediation goal equivalent for dioxin TEQ (81 pg/g) that is less than the originally proposed risk-based remediation goal of 5.3 mg/kg for concrete and shallow soil (upper 5 feet). Specifically, the total Aroclor concentrations corresponding to 81 pg/g dioxin TEQ on the regression line, the UCL, and the LCL are 3,540, 3,450, and 3,640  $\mu\text{g/kg}$  (3.54, 3.45, and 3.64 mg/kg), respectively. As a result, it would appear that a revised risk-based remediation goal for PCBs (as total Aroclors) of 3.5 mg/kg for concrete and soil that may be left exposed at the surface (at a depth interval of 0 to 5 feet bgs) would be adequately protective of PCBs as dioxin-like congeners. To determine if the originally proposed risk-based remediation goal for PCBs (as total Aroclors) in deeper soil of 35 mg/kg would be adequately protective, the results of the regression for the combined soil and concrete data (untransformed) were also plotted against this remediation goal along with the

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<sup>6</sup> The ratio of dioxin TEQ to total Aroclor concentration is the relationship between dioxin TEQ and total Aroclor concentration - should be independent of the magnitude of the total Aroclor concentration (i.e., the ratio should be constant with respect to total Aroclor concentration). That the regressions using log-transformed data yield curved lines in the non-transformed domain means that the regressions using log-transformed data suggest that the ratio varies with total Aroclor concentration, which should not be the case.

equivalent risk-based remediation goal for dioxin-like PCB congeners, 530 pg/g TEQ.<sup>7</sup> As shown in Figure 5, the regression using the combined soil and concrete data (untransformed) identifies a concentration of total Aroclors at the risk-based remediation goal equivalent for dioxin TEQ (530 pg/g) that is less than 35 mg/kg. As a result, it would appear that a revised risk-based remediation goal for PCBs (as total Aroclors) of 23 mg/kg for soil to be left below pavement or other ground cover that only construction workers may come into contact with during construction (or 5 feet below crushed concrete containing less than 3.5 mg/kg) would be adequately protective of PCBs as dioxin-like congeners.

#### **4.2 HUMAN HEALTH RISK CALCULATIONS FOR DIOXIN-LIKE PCB CONGENERS AND AROCLOR MIXTURES**

Potential human health risks associated with the dioxin-like PCB congener and Aroclor mixture data from the 2010 concrete and soil samples were also comparatively estimated to further assess the need to revise the proposed risk-based remediation goals based on Aroclor mixtures presented in Section 4.1.

Hypothetical, representative exposure point concentrations (EPCs) were calculated for the 12 dioxin-like PCB congeners and five Aroclor mixtures detected in the 2010 concrete and soil characterization samples. For the dioxin-like PCB congeners, EPCs were calculated for the individual congeners as well as for dioxin TEQ. For this evaluation, EPCs were calculated for the concrete and soil data combined, assuming that exposure of future workers is potentially complete for both media (i.e., assuming concrete building slabs may be demolished on site, crushed, and intermixed with soil for reuse in removal areas). U.S. EPA's ProUCL product (U.S. EPA, 2010d) was used to determine UCL of the mean EPCs for dioxin TEQ, each dioxin-like PCB congener, and each Aroclor mixture. The resulting ProUCL output is provided in Supplement A.

Potential human health risks from exposure to PCBs were then estimated by quantitatively comparing the resulting EPCs to the RBSLs presented above in Section 3.0. To streamline the evaluation, EPCs were only compared to the lowest of available RBSLs, the cancer-based RBSLs for outdoor commercial/industrial workers. Comparing the EPCs to these RBSLs would provide a conservative estimate of potential human health risks from exposure to PCBs as dioxin-like congeners versus PCBs as Aroclors. Predicted lifetime excess cancer risks were calculated for outdoor commercial/industrial workers by dividing each EPC by the appropriate cancer-based RBSL, and then multiplying these risk ratios by the target risk level used in the development of the RBSLs (i.e., one-in-one million or  $1 \times 10^{-6}$ ). Risks from exposure

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<sup>7</sup> Based on the carcinogenic RBSL for dioxin-like PCB congeners for construction workers (53 pg/g TEQ), adjusted to a target cancer risk of  $10^{-5}$ .

to dioxin-like PCB congeners were then comparatively evaluated to risks from exposure to the Aroclor mixtures.

The results of the analysis are presented in Table 9. As presented, the predicted lifetime excess cancer risk for outdoor commercial/industrial worker exposure to dioxin-like PCB congeners is  $2 \times 10^{-4}$  based on EPCs for each of the individual congeners, but  $8 \times 10^{-4}$  based on dioxin TEQ. The difference in these risk estimates can be attributed to the influence of elevated detection limits in the sample-specific calculations of dioxin TEQ. By comparison, the predicted lifetime excess cancer risk for outdoor commercial/industrial worker exposure to Aroclor mixtures is  $5 \times 10^{-4}$ . As a result, it would appear that, on average, the dioxin-like PCB congeners do not pose a more significant human health risk than PCBs evaluated as Aroclor mixtures, but on a sample-by-sample basis (as dioxin TEQ), the congeners present a slightly more significant human health risk than PCBs evaluated as Aroclor mixtures. These results are consistent with the results of the regression analysis. Given that the potential human health risks from dioxin-like PCB congeners as dioxin TEQ are slightly more significant than the potential human health risks from total Aroclors, a slight reduction of the risk-based remediation goals for PCBs as total Aroclors (as illustrated by the regression analyses) would be necessary to be adequately protective of PCBs as dioxin-like congeners.

## 5.0 SUMMARY OF REVISED PCB REMEDIATION GOALS

Based on the above evaluations, the revised PCB remediation goals proposed for the Site are summarized below.

1. Proposed Remediation Goals for PCBs in Concrete
  - a. **Total Aroclors – 3.5 mg/kg.** Based on the regression analysis for dioxin-like PCB congeners versus total Aroclors in combined soil and concrete, the total Aroclor concentration that would result in a maximum dioxin TEQ concentration of 81 pg/g.
2. Proposed Remediation Goals for PCBs in Shallow Soil (0 to 15 feet bgs)
  - a. **Aroclor-1254 – 2.0 mg/kg.** Based on the noncancer RBSL for construction workers and a target noncancer HI of 1.
  - b. **Total Aroclors – 3.5 mg/kg.** For soil that may be left exposed at the surface (upper 5 feet). Based on the regression analysis for dioxin-like PCB congeners versus total Aroclors in combined soil and concrete, the total Aroclor concentration that would result in a maximum dioxin TEQ concentration of 81 pg/g.

- c. **Total Aroclors – 23 mg/kg.** For soil to be left below pavement or other ground cover that only construction workers may come into contact with during construction (or 5 feet below crushed concrete containing less than 3.5 mg/kg). Based on the regression analysis for dioxin-like PCB congeners versus total Aroclors in combined soil and concrete, the total Aroclor concentration that would result in a maximum dioxin TEQ concentration of 530 pg/g.

## 6.0 REFERENCES

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## TABLES

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**TABLE 1**  
**POLYCHLORINATED BIPHENYLS IN CONCRETE (SEPTEMBER - OCTOBER 2010)**

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Results shown in micrograms per kilogram (µg/kg)

Sample Location	Sample ID	Phase Area	Sample Depth <sup>1</sup> (Feet)	Sample Date	EPA Method	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total PCBs (sum of Aroclors tested)	Data Source
C-12	C-12-A	I	0	09/15/10	8082	<20 <sup>2</sup>	<20	<20	<20	110	<20	<20	110	AMEC Geomatrix
DC-154	DC-154-A	I	0	09/15/10	8082	<1000	<1000	<1000	<1000	12,000	<1000	1400	13,400	AMEC Geomatrix
DC-168	DC-168-C	I	0	09/15/10	8082	<20,000	<20,000	<20,000	<20,000	390,000	<20,000	200,000	590,000	AMEC Geomatrix
DC-168	DC-168-A/DC-168-B	I	0	09/15/10	8082	<20,000	<20,000	<20,000	<20,000	160,000	<20,000	40,000	200,000	AMEC Geomatrix
DC-205	DC-205-A	I	0	09/14/10	8082	<20	<20	<20	<20	41	<20	31	72	AMEC Geomatrix
DC-206	DC-206-A	I	0	09/14/10	8082	<20	<20	<20	<20	50	<20	26	76	AMEC Geomatrix
DC-207	DC-207-A	I	0	09/14/10	8082	<1000	<1000	<1000	<1000	2300	<1000	<1000	2300	AMEC Geomatrix
DC-208	DC-208-A	I	0	09/14/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	AMEC Geomatrix
DC-209	DC-209-A	I	0	09/14/10	8082	<20	<20	<20	<20	20	<20	<20	20	AMEC Geomatrix
DC-210	DC-210-A	I	0	09/15/10	8082	<20	<20	<20	<20	29	<20	<20	29	AMEC Geomatrix
DC-211	DC-211-A	I	0	09/14/10	8082	<100	<100	<100	<100	1400	<100	780	2180	AMEC Geomatrix
DC-212	DC-212-A	I	0	09/14/10	8082	<20	<20	<20	<20	43	<20	<20	43	AMEC Geomatrix
DC-213	DC-213-A	I	0	09/15/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	AMEC Geomatrix
DC-214	DC-214-A1	I	0	09/14/10	8082	<20	<20	<20	<20	220	<20	43	263	AMEC Geomatrix
DC-215	DC-215-A	I	0	09/14/10	8082	<20	<20	<20	<20	140	<20	31	171	AMEC Geomatrix
DC-216	DC-216-A	I	0	09/15/10	8082	<200	<200	<200	<200	1900	<200	720	2620	AMEC Geomatrix
DC-217	DC-217-A	I	0	09/13/10	8082	<20	<20	<20	<20	<20	230	130	360	AMEC Geomatrix
DC-218	DC-218-A	I	0	09/13/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	AMEC Geomatrix
DC-263	DC-263-A	I	0	10/15/10	8082	<100	<100	<100	<100	1000	<100	120	1120	AMEC Geomatrix
DC-264	DC-264-A	I	0	10/15/10	8082	<400	<400	<400	<400	3800	5400	2200	11,400	AMEC Geomatrix
DC-265	DC-265-A	I	0	10/15/10	8082	<200	<200	<200	<200	380	690	340	1410	AMEC Geomatrix
DC-266	DC-266-A	I	0	10/15/10	8082	<400	<400	<400	<400	4100	5800	2200	12,100	AMEC Geomatrix
DC-267	DC-267-A	I	0	10/18/10	8082	<200	<200	<200	<200	770	<200	370	1140	AMEC Geomatrix
DC-268	DC-268-A	I	0	10/18/10	8082	<200	<200	<200	<200	540	<200	200	740	AMEC Geomatrix
DC-269	DC-269-A	I	0	10/18/10	8082	<20	<20	<20	<20	34	<20	24	58	AMEC Geomatrix
DC-270	DC-270-A	I	0	10/18/10	8082	<200	<200	<200	<200	1000	2700	1000	4700	AMEC Geomatrix
DC-271	DC-271-A	I	0	10/18/10	8082	<200	<200	<200	<200	310	<200	<200	310	AMEC Geomatrix
DC-272	DC-272-A	I	0	10/18/10	8082	<200	<200	<200	<200	650	<200	<200	650	AMEC Geomatrix
DC-273	DC-273-A	I	0	10/18/10	8082	<200	<200	<200	<200	420	<200	<200	420	AMEC Geomatrix
DC-274	DC-274-A	I	0	10/18/10	8082	<200	<200	<200	<200	460	<200	<200	460	AMEC Geomatrix

**TABLE 1**  
**POLYCHLORINATED BIPHENYLS IN CONCRETE (SEPTEMBER - OCTOBER 2010)**  
Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Results shown in micrograms per kilogram (µg/kg)

Sample Location	Sample ID	Phase Area	Sample Depth <sup>1</sup> (Feet)	Sample Date	EPA Method	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total PCBs (sum of Aroclors tested)	Data Source
DC-275	DC-275-A	I	0	10/18/10	8082	<200	<200	<200	<200	1300	<200	440	1740	AMEC Geomatrix
DC-276	DC-276-A	I	0	10/18/10	8082	<20,000	<20,000	<20,000	<20,000	99,000	<20,000	<20,000	99,000	AMEC Geomatrix
C-14	C-14-A	IIA/IIB	0	09/15/10	8082	<20	<20	<20	<20	38	<20	74	112	AMEC Geomatrix
DC-22	DC-22-A	IIA/IIB	0	09/15/10	8082	<20	<20	<20	<20	39	<20	130	169	AMEC Geomatrix
DC-23	DC-23-A	IIA/IIB	0	09/15/10	8082	<20	<20	<20	<20	370	<20	810	1180	AMEC Geomatrix
DC-52	DC-52-A	IIA/IIB	0	09/15/10	8082	<20	<20	<20	<20	41	<20	33	74	AMEC Geomatrix
DC-219	DC-219-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	38	<20	<20	38	AMEC Geomatrix
DC-220	DC-220-A	IIA/IIB	0	09/14/10	8082	<20	<20	<20	<20	97	100	96	293	AMEC Geomatrix
DC-221	DC-221-A	IIA/IIB	0	09/14/10	8082	<20	<20	<20	<20	97	<20	61	158	AMEC Geomatrix
DC-222	DC-222-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	22	<20	29	51	AMEC Geomatrix
DC-223	DC-223-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	1300	<20	96	1396	AMEC Geomatrix
DC-224	DC-224-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	<20	<20	20	20	AMEC Geomatrix
DC-225	DC-225-A	IIA/IIB	0	09/10/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	AMEC Geomatrix
DC-226	DC-226-A1	IIA/IIB	0	09/10/10	8082	<20	<20	<20	<20	<20	<20	28	28	AMEC Geomatrix
DC-227	DC-227-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	<20	260	150	410	AMEC Geomatrix
DC-228	DC-228-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	AMEC Geomatrix
DC-229	DC-229-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	39	<20	50	89	AMEC Geomatrix
DC-230	DC-230-A	IIA/IIB	0	09/10/10	8082	26	<20	<20	<20	36	<20	42	104	AMEC Geomatrix
DC-231	DC-231-A	IIA/IIB	0	09/10/10	8082	<20	<20	<20	<20	20	<20	20	40	AMEC Geomatrix
DC-236	DC-236-A	IIA/IIB	0	09/10/10	8082	<20	<20	<20	<20	<20	<20	24	24	AMEC Geomatrix
DC-246	DC-246-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	<20	57	39	96	AMEC Geomatrix
DC-247	DC-247-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	28	<20	62	90	AMEC Geomatrix
DC-248	DC-248-A	IIA/IIB	0	09/13/10	8082	<1000	<1000	<1000	<1000	65,000	<1000	2800	67,800	AMEC Geomatrix
DC-249	DC-249-A1	IIA/IIB	0	09/15/10	8082	<20	<20	<20	<20	45	<20	<20	45	AMEC Geomatrix
DC-250	DC-250-A	IIA/IIB	0	09/14/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	AMEC Geomatrix
DC-251	DC-251-A	IIA/IIB	0	09/14/10	8082	<20	<20	<20	<20	77	<20	45	122	AMEC Geomatrix
DC-252	DC-252-A	IIA/IIB	0	09/14/10	8082	<20	<20	<20	<20	44	<20	20	64	AMEC Geomatrix
DC-253	DC-253-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	<20	<20	25	25	AMEC Geomatrix
DC-254	DC-254-A	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	40	<20	<20	40	AMEC Geomatrix
DC-255	DC-255-A	IIA/IIB	0	10/15/10	8082	<200	<200	<200	<200	1600	<200	150	1750	AMEC Geomatrix

**TABLE 1**  
**POLYCHLORINATED BIPHENYLS IN CONCRETE (SEPTEMBER - OCTOBER 2010)**  
Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Results shown in micrograms per kilogram (µg/kg)

Sample Location	Sample ID	Phase Area	Sample Depth <sup>1</sup> (Feet)	Sample Date	EPA Method	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total PCBs (sum of Aroclors tested)	Data Source
DC-256	DC-256-A	IIA/IIB	0	10/15/10	8082	<20	<20	<20	<20	310	<20	72	382	AMEC Geomatrix
DC-257	DC-257-A	IIA/IIB	0	10/15/10	8082	<40	<40	<40	<40	210	<40	61	271	AMEC Geomatrix
DC-258	DC-258-A	IIA/IIB	0	10/15/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	AMEC Geomatrix
DC-259	DC-259-A	IIA/IIB	0	10/15/10	8082	<20	<20	<20	<20	24	<20	61	85	AMEC Geomatrix
DC-260	DC-260-A	IIA/IIB	0	10/15/10	8082	<200	<200	<200	<200	1800	<200	<200	1800	AMEC Geomatrix
DC-261	DC-261-A	IIA/IIB	0	10/15/10	8082	<20	<20	<20	<20	56	<20	<20	56	AMEC Geomatrix
DC-262	DC-262-A	IIA/IIB	0	10/15/10	8082	<200	<200	<200	<200	280	<200	<200	280	AMEC Geomatrix
B-1	B-1-A1	IV	0	09/15/10	8082	<20	<20	<20	<20	320	<20	280	600	AMEC Geomatrix
DC-25	DC-25-A	IV	0	09/15/10	8082	<20	<20	<20	<20	<20	<20	28	28	AMEC Geomatrix
DC-232	DC-232-A	IV	0	09/10/10	8082	<20	<20	<20	<20	<20	1000	<20	1000	AMEC Geomatrix
DC-233	DC-233-A	IV	0	09/10/10	8082	<20	<20	<20	<20	53	<20	260	313	AMEC Geomatrix
DC-234	DC-234-A	IV	0	09/09/10	8082	<20	<20	<20	<20	<20	<20	40	40	AMEC Geomatrix
DC-235	DC-235-A	IV	0	09/10/10	8082	320	<200	<200	<200	<200	<200	210	530	AMEC Geomatrix
DC-237	DC-237-A	IV	0	09/09/10	8082	<20	<20	<20	<20	<20	<20	86	86	AMEC Geomatrix
DC-238	DC-238-A	IV	0	09/09/10	8082	<20	<20	<20	<20	<20	<20	40	40	AMEC Geomatrix
DC-239	DC-239-A	IV	0	09/09/10	8082	27	<20	<20	<20	<20	<20	65	92	AMEC Geomatrix
DC-240	DC-240-A	IV	0	09/09/10	8082	<200	<200	<200	<200	<200	<200	<200	<200	AMEC Geomatrix
DC-241	DC-241-A	IV	0	09/09/10	8082	<20	<20	<20	<20	<20	<20	20	20	AMEC Geomatrix
DC-242	DC-242-A	IV	0	09/09/10	8082	<20	<20	<20	<20	<20	<20	24	24	AMEC Geomatrix
DC-243	DC-243-A	IV	0	09/09/10	8082	<20	<20	<20	<20	<20	<20	23	23	AMEC Geomatrix
DC-244	DC-244-A	IV	0	09/09/10	8082	41	<20	<20	<20	58	<20	82	181	AMEC Geomatrix
DC-245	DC-245-A	IV	0	09/10/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	AMEC Geomatrix

**Notes:**

1. Depth = top of sample depth measured in feet below ground surface.
2. < = not detected at or above the reporting limit shown.

**Data Source:**

AMEC Geomatrix = "B", "C", and "DC" concrete samples collected during PCB characterization and verification sampling.

**TABLE 2**  
**POLYCHLORINATED BIPHENYLS IN SOIL (SEPTEMBER - OCTOBER 2010)**  
Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Results shown in micrograms per kilogram (µg/kg)

Sample	Phase Area	Sample Depth <sup>1</sup>	Sample Date	EPA Method	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total PCBs (sum of Aroclors tested)	Excavated Status <sup>2</sup>	Data Source
Industrial PRGs					21,246	NE <sup>3</sup>	NE	NE	NE	744	NE	NE	--	--
184-SS-01	I	1.7	09/13/10	8082	<20 <sup>4</sup>	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
185-SS-01	I	2.4	09/13/10	8082	<20	<20	<20	<20	190	<20	<20	190	--	AMEC Geomatrix
187-SS-01	I	1.8	09/14/10	8082	<20	<20	<20	<20	47	<20	51	98	--	AMEC Geomatrix
190-SS-01	I	0.9	09/24/10	8082	<20	<20	<20	<20	80	<20	<20	80	--	AMEC Geomatrix
191-SS-01	I	1.0	09/24/10	8082	<1000	<1000	<1000	<1000	<b>11,000</b>	<1000	<1000	<b>11,000</b>	--	AMEC Geomatrix
192-SS-01	I	0.9	09/24/10	8082	<20	<20	<20	<20	23	<20	<20	23	--	AMEC Geomatrix
193-SS-01	I	1.0	09/24/10	8082	<100,000	<100,000	<100,000	<100,000	<b>1,000,000</b>	<100,000	<100,000	<b>1,000,000</b>	--	AMEC Geomatrix
194-SS-01	I	0.9	09/24/10	8082	<400	<400	<400	<400	450	<400	<400	450	--	AMEC Geomatrix
195-SS-01	I	0.9	09/24/10	8082	<10,000	<10,000	<10,000	<10,000	<b>94,000</b>	<10,000	<10,000	<b>94,000</b>	--	AMEC Geomatrix
196-SS-01	I	0.8	09/24/10	8082	<20	<20	<20	<20	730	<20	150	<b>880</b>	--	AMEC Geomatrix
197-SS-01	I	0.9	09/24/10	8082	<100	<100	<100	<100	390	<100	<100	390	--	AMEC Geomatrix
198-SS-01	I	0.9	09/24/10	8082	<40	<40	<40	<40	190	<40	<40	190	--	AMEC Geomatrix
199-SS-01	I	0.9	09/24/10	8082	<40	<40	<40	<40	160	<40	110	270	--	AMEC Geomatrix
200-SS-01	I	1.0	09/24/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
201-SS-01	I	1.0	09/24/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
202-SS-01	I	1.2	09/24/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
203-SS-01	I	1.1	09/24/10	8082	250	<40	<40	<40	<40	<40	<40	250	--	AMEC Geomatrix
204-SS-01	I	0.9	09/24/10	8082	<200	<200	<200	<200	<b>1800</b>	<200	<200	<b>1800</b>	--	AMEC Geomatrix
205-SS-01	I	0.9	09/24/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
206-SS-01	I	0.9	09/24/10	8082	<200	<200	<200	<200	<b>1100</b>	<200	<200	<b>1100</b>	--	AMEC Geomatrix
208-SS-01	I	1.2	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
209-SS-01	I	1.2	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
210-SS-01	I	1.1	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
211-SS-01	I	1.8	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
212-SS-01	I	1.2	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
213-SS-01	I	1.0	09/24/10	8082	<100	<100	<100	<100	240	<100	<100	240	--	AMEC Geomatrix
214-SS-01	I	0.9	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
215-SS-01	I	1.1	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
216-SS-01	I	1.2	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
217-SS-01	I	1.2	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
218-SS-01	I	1.2	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
219-SS-01	I	1.2	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
220-SS-01	I	1.2	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
178-SS-01	IIA/IIB	0	09/13/10	8082	<20	<20	<20	<20	270	<20	180	450	--	AMEC Geomatrix
181-SS-01	IIA/IIB	5.7	09/13/10	8082	<20	<20	<20	<20	54	56	30	140	--	AMEC Geomatrix
182-SS-01	IIA/IIB	5.7	09/13/10	8082	<1000	<1000	<1000	<1000	<b>14,000</b>	<b>19,000</b>	<b>26,000</b>	<b>59,000</b>	--	AMEC Geomatrix
188-SS-01	IIA/IIB	2.3	09/13/10	8082	38	<20	<20	<20	<20	<20	<20	38	--	AMEC Geomatrix
189-SS-01	IIA/IIB	4.7	09/14/10	8082	<20	<20	610	<20	<20	<20	<20	610	--	AMEC Geomatrix
189-SS-02	IIA/IIB	9.7	09/14/10	8082	<100	<100	<100	<100	<b>1400</b>	<100	<100	<b>1400</b>	--	AMEC Geomatrix

**TABLE 2**  
**POLYCHLORINATED BIPHENYLS IN SOIL (SEPTEMBER - OCTOBER 2010)**  
Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Results shown in micrograms per kilogram (µg/kg)

Sample	Phase Area	Sample Depth <sup>1</sup>	Sample Date	EPA Method	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total PCBs (sum of Aroclors tested)	Excavated Status <sup>2</sup>	Data Source
Industrial PRGs					21,246	NE <sup>3</sup>	NE	NE	NE	744	NE	NE	--	--
221-SS-01	IIA/IIB	0.8	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
222-SS-01	IIA/IIB	0.7	09/23/10	8082	<20	<20	<20	<20	<20	84	<20	84	--	AMEC Geomatrix
223-SS-01	IIA/IIB	1.2	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
224-SS-01	IIA/IIB	0.7	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
225-SS-01	IIA/IIB	0.7	09/23/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix
226-SS-01	IIA/IIB	0.7	09/23/10	8082	<20	<20	<20	<20	120	<20	<20	120	--	AMEC Geomatrix
227-SS-01	IIA/IIB	0.8	09/23/10	8082	<20	<20	<20	<20	<20	150	<20	150	--	AMEC Geomatrix
228-SS-01	IIA/IIB	0.7	09/23/10	8082	<100	<100	<100	<100	3200	<100	610	3810	--	AMEC Geomatrix
229-SS-01	IIA/IIB	1.0	09/23/10	8082	<10,000	<10,000	<10,000	<10,000	610,000	<10,000	22,000	632,000	--	AMEC Geomatrix
230-SS-01	IIA/IIB	0.9	09/24/10	8082	<10,000	<10,000	<10,000	<10,000	1,500,000	<10,000	40,000	1,540,000	--	AMEC Geomatrix
231-SS-01	IIA/IIB	0.8	09/24/10	8082	<10,000	<10,000	<10,000	<10,000	1,500,000	<10,000	60,000	1,560,000	--	AMEC Geomatrix
232-SS-01	IIA/IIB	0.9	09/24/10	8082	<4000	<4000	<4000	<4000	31,000	<4000	<4000	31,000	--	AMEC Geomatrix
233-SS-01	IIA/IIB	0.8	09/24/10	8082	<10,000	<10,000	<10,000	<10,000	1,900,000	<10,000	55,000	1,955,000	--	AMEC Geomatrix
234-SS-01	IIA/IIB	0.9	09/24/10	8082	<20	<20	<20	<20	250	<20	<20	250	--	AMEC Geomatrix
235-SS-01	IIA/IIB	1.0	09/24/10	8082	<20	<20	<20	<20	230	<20	<20	230	--	AMEC Geomatrix
236-SS-01	IIA/IIB	0.8	09/24/10	8082	<10,000	<10,000	<10,000	<10,000	1,100,000	<10,000	23,000	1,123,000	--	AMEC Geomatrix
237-SS-01	IIA/IIB	0.7	09/24/10	8082	<20	<20	<20	<20	220	<20	<20	220	--	AMEC Geomatrix
238-SS-01	IIA/IIB	0.8	09/24/10	8082	<100	<100	<100	<100	660	<100	<100	660	--	AMEC Geomatrix
175-SS-01	IIIA	2.7	09/13/10	8082	<20	<20	<20	<20	3400	<20	500	3900	--	AMEC Geomatrix
175-SS-01 <sup>5</sup>	IIIA	2.7	09/13/10	8082	<200	<200	<200	<200	3500	3900	720	8120	--	AMEC Geomatrix
175-SS-01 <sup>5</sup>	IIIA	2.7	09/13/10	8082	<200	<200	<200	<200	3900	3900	780	8580	--	AMEC Geomatrix
176-SS-01	IIIA	4.5	09/14/10	8082	<100	<100	<100	<100	20,000	<100	860	20,860	--	AMEC Geomatrix
177-SS-01	IIIA	4.5	09/14/10	8082	<20	<20	<20	<20	130	<20	<20	130	--	AMEC Geomatrix
180-SS-01	IIIA	4.5	09/14/10	8082	<20	<20	<20	<20	65	<20	26	91	--	AMEC Geomatrix
180-SS-02	IIIA	9.5	09/14/10	8082	<20	<20	<20	<20	160	<20	<20	160	--	AMEC Geomatrix
179-SS-01	IV	0.8	09/13/10	8082	<100	<100	<100	<100	130	<100	340	470	--	AMEC Geomatrix
183-SS-01	IV	0.8	09/13/10	8082	<20	<20	<20	<20	680	2300	350	3330	--	AMEC Geomatrix
183-SS-01 <sup>5</sup>	IV	0.8	09/13/10	8082	<200	<200	<200	<200	680	2000	380	3060	--	AMEC Geomatrix
183-SS-01 <sup>5</sup>	IV	0.8	09/13/10	8082	<200	<200	<200	<200	650	2200	410	3260	--	AMEC Geomatrix
186-SS-01	VI	2.0	09/14/10	8082	<20	<20	<20	<20	<20	<20	<20	<20	--	AMEC Geomatrix

**Notes**

1. Depth = top of sample depth measured in feet below ground surface.
2. Samples which have been previously excavated are listed "excavated".
3. NE = not established.
4. < = not detected at or above the reporting limit shown.
5. Samples were reanalyzed to verify concentrations of PCB aroclors in primary samples. Samples were analyzed past the EPA-recommended hold time.

**Data Source**

AMEC Geomatrix = soil samples collected during additional PCB sampling outlined in the Sampling and Analysis Plan.

**TABLE 3**

**DIOXIN-LIKE POLYCHLORINATED BIPHENYL (PCB) CONGENERS IN CONCRETE**

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Concentrations reported in picograms per gram (pg/g)

Sample Location	Sample ID	Phase Area	Sample Depth <sup>1</sup>	Sample Date	PCB 77	PCB 81	PCB 105	PCB 114	PCB 118	PCB 123	PCB 126	PCB 156, 157	PCB 167	PCB 169	PCB 189	Dioxin TEQ <sup>2</sup>
WHO 2005 TEF <sup>3</sup>					0.0001	0.0003	0.00003	0.00003	0.00003	0.00003	0.1	0.00003	0.00003	0.03	0.00003	-- <sup>4</sup>
C-12	C-12-A	I	0	09/15/10	190	<11.7 <sup>5</sup>	825	<45.5	1440	<39.5	<52.6	143	49.0	<15.9	19.9	2.96
DC-154	DC-154-A	I	0	09/15/10	119,000	4660	457,000	28,900	703,000	11,500	5960	44,700	13,200	<564	2630	656
DC-168	DC-168-C	I	0	09/15/10	2,730,000	164,000	10,500,000	842,000	18,100,000	560,000	124,000	1,530,000	509,000	<37,214	302,000	14,250
C-14	C-14-A	IIA/IIB	0	09/15/10	131	<29.2	420	<72.4	920	<59.9	<100	242	98.6	<53.3	45.6	5.87
DC-22	DC-22-A	IIA/IIB	0	09/15/10	1010	<413	3310	<440	7990	405	<339	1300	1020	238	535	24.7
DC-23	DC-23-A	IIA/IIB	0	09/15/10	4060	<1546	13,900	<1109	26,200	<1135	<842	4340	2740	<536	1030	52.3
DC-52	DC-52-A	IIA/IIB	0	09/15/10	659	<59.3	2220	99.3	2990	104	<82.4	216	136	<50.5	41.7	5.13
B-1	B-1-A4 <sup>6</sup>	IV	0	09/15/10	4600	<2171	14,600	<1746	25,200	<1546	<1647	1700	<1000	<677	<581	94.6
DC-25	DC-25-A	IV	0	09/15/10	77.9	<32.6	260	<46.8	389	<39.3	<45.1	<46.6	58	<34.8	28.5	2.81

**Notes:**

1. Depth = top of sample depth measured in feet below ground surface.
2. TEQ = Toxic Equivalent. Dioxin TEQ concentrations are calculated as the sum of the concentration of each dioxin-like PCB congener times the congener-specific toxic equivalency factor (TEF). The dioxin-like PCB congener concentrations in concrete and TEFs are listed above. Results below the reporting limit are represented by a value of one half the reporting limit in the dioxin TEQ concentration calculations.
3. WHO 2005 TEF = World Health Organization toxicity equivalency factors (TEF), released in 2005, but published in 2006 by Van den Berg, M. et al. ("The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds," Toxicological Sciences, 93[2]: 223-241, October).
4. -- = not applicable.
5. < = not detected at or above the reporting limit shown.
6. Samples B-1-A1, B-1-A4, and B-1-A5 were collected from the same area. Of the three samples, sample B-1-A4 was selected by SGS for analysis of PCB congeners.

**TABLE 4**

**DIOXIN-LIKE POLYCHLORINATED BIPHENYL (PCB) CONGENERS IN SOIL**

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Concentrations reported in picograms per gram (pg/g)

Sample Location	Sample ID	Phase Area	Sample Depth <sup>1</sup>	Sample Date	PCB 77	PCB 81	PCB 105	PCB 114	PCB 118	PCB 123	PCB 126	PCB 156, 157	PCB 167	PCB 169	PCB 189	Dioxin TEQ <sup>2</sup>
WHO 2005 TEF <sup>3</sup>					0.0001	0.0003	0.00003	0.00003	0.00003	0.00003	0.1	0.00003	0.00003	0.03	0.00003	-- <sup>4</sup>
#184	184-SS-01	I	1.7	09/13/10	4.18	<2.37 <sup>5</sup>	36.6	<4.33	75.4	<3.59	<4.44	28.2	9.91	<4.28	2.82	0.29
#185	185-SS-01	I	2.4	09/13/10	5.74	<5.18	40.2	5.85	176	5.74	<2.72	6.58	<2.77	<2.39	1.25	0.18
#187	187-SS-01	I	1.8	09/14/10	<60.1	<55.0	2200	<216	2740	<227	<306	4760	1540	<139	176	17.7
#178	178-SS-01	IIA/IIB	0	09/13/10	11,900	<698	44,200	1060	75,200	8030	<925	7250	2450	<216	487	54.9
#181	181-SS-01	IIA/IIB	5.7	09/13/10	959	43.3	3620	253	5950	141	61.0	597	191	9.68	66.7	6.82
#182	182-SS-01	IIA/IIB	5.7	09/13/10	131,000	<15,391	565,000	25,400	1,030,000	22,400	<8373	157,000	56,300	<5493	23,100	573
#188	188-SS-01	IIA/IIB	2.3	09/13/10	26.5	<2.60	99.0	6.87	156	4.03	<2.16	7.68	2.73	<1.09	<1.12	0.14
#189	189-SS-01	IIA/IIB	4.7	09/14/10	41.9	<10.7	94.0	<8.38	198	<6.87	<8.89	8.55	<3.44	<3.30	<2.00	0.51
#189	189-SS-02	IIA/IIB	9.7	09/14/10	690	<87.7	33,900	1170	31,800	1040	<47.6	931	169	<11.5	6.57	4.71
#175	175-SS-01	IIIA	2.7	09/13/10	51,500	3130	246,000	18,700	320,000	7200	3450	20,900	5760	252	1210	377
#176	176-SS-01	IIIA	4.5	09/14/10	102,000	4230	322,000	23,000	446,000	13,400	3090	22,000	6090	103	937	349
#177	177-SS-01	IIIA	4.5	09/14/10	4080	<112	9320	503	14,200	368	85.5	464	127	<4.26	17.4	9.79
#180	180-SS-01	IIIA	4.5	09/14/10	1020	39.5	3570	232	6250	117	79.1	644	163	<11.4	36.1	8.53
#180	180-SS-02	IIIA	9.5	09/14/10	382	16.4	1140	84.1	2150	50.4	17.1	128	37.3	<2.64	6.30	1.90
#179	179-SS-01	IV	0.8	09/13/10	<1984	<1837	4220	<1834	6710	<1630	<1716	<1470	<1316	<1296	<967	106
#183	183-SS-01	IV	0.8	09/13/10	32,200	1160	111,000	6490	169,000	4620	1140	8740	2310	49.2	516	128
#186	186-SS-01	VI	2.0	09/14/10	15.4	<4.97	40.4	<4.58	60.9	<4.31	<4.32	5.27	1.97	<1.58	<1.17	0.25

**Notes:**

1. Depth = top of sample depth measured in feet below ground surface.
2. TEQ = Toxic Equivalent. Dioxin TEQ concentrations are calculated as the sum of the concentration of each dioxin-like PCB congener times the congener-specific toxic equivalency factor (TEF). The dioxin-like PCB congener concentrations in soil and TEFs are listed above. Results below the reporting limit are represented by a value of one half the reporting limit in the dioxin TEQ concentration calculations.
3. WHO 2005 TEF = World Health Organization toxicity equivalency factors (TEF), released in 2005, but published in 2006 by Van den Berg, M. et al. ("The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds," Toxicological Sciences, 93(2): 223-241, October).
4. -- = not applicable.
5. < = not detected at or above the reporting limit shown.

**TABLE 5**

**EXPOSURE PARAMETERS USED IN DEVELOPING RISK-BASED SCREENING LEVELS FOR PCBs FOR OUTDOOR COMMERCIAL/INDUSTRIAL WORKERS**

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Exposure Parameter	Units	Reasonable Maximum Exposure
<b>GENERAL EXPOSURE PARAMETERS</b>		
Exposure Frequency (EF)	days/year	Value: 250 Rationale: DTSC, 2005
Exposure Duration (ED)	years	Value: 25 Rationale: DTSC, 2005
Body Weight (BW)	kg	Value: 70 Rationale: DTSC, 2005
Averaging Time (AT)	days	Value: 25,550 (carcinogens) 9,125 (noncarcinogens) Rationale: DTSC, 2005
<b>PATHWAY-SPECIFIC PARAMETERS</b>		
<b>Incidental Soil Ingestion</b>		
Soil Ingestion Rate (IR <sub>s</sub> )	mg/day	Value: 100 Rationale: DTSC, 2005
<b>Dermal Contact with Soil</b>		
Exposed Skin Surface Area (SA <sub>s</sub> )	cm <sup>2</sup> /day	Value: 5,700 Rationale: DTSC, 2005; assumes head, hands, forearms, and lower legs are exposed
Soil-to-Skin Adherence Factor (SAF)	mg/cm <sup>2</sup>	Value: 0.2 Rationale: DTSC, 2005
Absorption Fraction (ABS)	unitless	Value: 0.15 Rationale: DTSC, 2005; chemical-specific value

**TABLE 5**

**EXPOSURE PARAMETERS USED IN DEVELOPING RISK-BASED SCREENING LEVELS FOR PCBs FOR OUTDOOR COMMERCIAL/INDUSTRIAL WORKERS**

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Exposure Parameter	Units	Reasonable Maximum Exposure
<b>Inhalation of Suspended Soil Particulates</b>		
Inhalation Rate (IHR <sub>a</sub> )	m <sup>3</sup> /day	Value: 14 Rationale: DTSC, 2005; for an 8-hour workday
Particulate Emission Factor (PEF)	m <sup>3</sup> /kg	Value: 1.316x10 <sup>9</sup> Rationale: DTSC, 2005

Abbreviations:

cm<sup>2</sup>/day = centimeters squared per day

kg = kilograms

m<sup>3</sup>/day = cubic meters per day

m<sup>3</sup>/kg = cubic meters per kilogram

mg/cm<sup>2</sup> = milligrams per squared centimeters

mg/day = milligrams per day

References:

Department of Toxic Substances Control (DTSC), 2005, Recommended DTSC Default Exposure Factors for Use In Risk Assessment at California Military Facilities, Human and Ecological Risk Division (HERD), HERD HHRA Note Number 1, October 27.

**TABLE 6**  
**EXPOSURE PARAMETERS USED IN DEVELOPING RISK-BASED SCREENING**  
**LEVELS FOR PCBs FOR CONSTRUCTION WORKERS**

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Exposure Parameter	Units	Reasonable Maximum Exposure
<b>GENERAL EXPOSURE PARAMETERS</b>		
Exposure Frequency (EF)	days/year	Value: 250 Rationale: DTSC, 2005
Exposure Duration (ED)	years	Value: 1 Rationale: DTSC, 2005
Body Weight (BW)	kg	Value: 70 Rationale: DTSC, 2005
Averaging Time (AT)	days	Value: 25,550 (carcinogens) 365 (noncarcinogens) Rationale: DTSC, 2005
<b>Pathway-Specific Parameters</b>		
<b>Incidental Soil Ingestion</b>		
Soil Ingestion Rate (IR <sub>s</sub> )	mg/day	Value: 330 Rationale: DTSC, 2005
<b>Dermal Contact with Soil</b>		
Exposed Skin Surface Area (SA <sub>s</sub> )	cm <sup>2</sup>	Value: 5,700 Rationale: DTSC, 2005; assumes head, hands, forearms, and lower legs are exposed
Soil-to-Skin Adherence Factor (SAF)	mg/cm <sup>2</sup>	Value: 0.8 Rationale: DTSC, 2005
Absorption Fraction (ABS <sub>d</sub> s)	unitless	Value: 0.15 Rationale: DTSC, 2005; chemical-specific value

**TABLE 6**  
**EXPOSURE PARAMETERS USED IN DEVELOPING RISK-BASED SCREENING**  
**LEVELS FOR PCBs FOR CONSTRUCTION WORKERS**

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Exposure Parameter	Units	Reasonable Maximum Exposure
<b>Inhalation of Suspended Soil Particulates</b>		
Inhalation Rate (IHR <sub>a</sub> )	m <sup>3</sup> /day	Value: 20 Rationale: DTSC, 2005; for an 8-hour workday
Particulate Emission Factor (PEF)	m <sup>3</sup> /kg	Value: 1.0x10 <sup>6</sup> Rationale: DTSC, 2005

Abbreviations:

cm<sup>2</sup>/day = centimeters squared per day

kg = kilograms

m<sup>3</sup>/day = cubic meters per day

m<sup>3</sup>/kg = cubic meters per kilogram

mg/cm<sup>2</sup> = milligrams per squared centimeters

mg/day = milligrams per day

References:

Department of Toxic Substances Control (DTSC), 2005, Recommended DTSC Default Exposure Factors for Use In Risk Assessment at California Military Facilities, Human and Ecological Risk Division (HERD), HERD HHRA Note Number 1, October 27.

TABLE 7  
RISK-BASED SCREENING LEVELS<sup>1</sup> FOR AROCLOR-1016 AND THE DIOXIN-LIKE PCB CONGENERS  
Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

CAS No.	Chemical	Oral Cancer Slope Factor (CSF <sub>o</sub> ) <sup>2</sup> (mg/kg-day) <sup>-1</sup>	Inhalation Cancer Slope Factor (CSF <sub>i</sub> ) <sup>2</sup> (mg/kg-day) <sup>-1</sup>	Oral Reference Dose (RfDo) <sup>3</sup> (mg/kg-day)	Inhalation Reference Dose (RfDi) <sup>3</sup> (mg/kg-day)	RISK-BASED SCREENING LEVELS (RBSLs), SOIL			
						Outdoor Commercial/Industrial Worker		Construction Worker	
						Cancer	Noncancer	Cancer	Noncancer
						(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
12674112	Aroclor-1016	2	2	7.0E-05	7.0E-05	5.3E-01	2.6E+01	3.5E+00	6.9E+00
32598133	PCB 77	13	13	1.0E-05	1.1E-04	8.1E-02	3.8E+00	5.3E-01	1.0E+00
70362504	PCB 81	39	39	3.3E-06	3.8E-05	2.7E-02	1.3E+00	1.8E-01	3.4E-01
32598144	PCB 105	3.9	3.9	3.3E-05	3.8E-04	2.7E-01	1.3E+01	1.8E+00	3.4E+00
74472370	PCB 114	3.9	3.9	3.3E-05	3.8E-04	2.7E-01	1.3E+01	1.8E+00	3.4E+00
31508006	PCB 118	3.9	3.9	3.3E-05	3.8E-04	2.7E-01	1.3E+01	1.8E+00	3.4E+00
65510443	PCB 123	3.9	3.9	3.3E-05	3.8E-04	2.7E-01	1.3E+01	1.8E+00	3.4E+00
57465288	PCB 126	13000	13000	1.0E-08	1.1E-07	8.1E-05	3.8E-03	5.3E-04	1.0E-03
38380084 <sup>4</sup>	PCB 156, 157	3.9	3.9	3.3E-05	3.8E-04	2.7E-01	1.3E+01	1.8E+00	3.4E+00
52663726	PCB 167	3.9	3.9	3.3E-05	3.8E-04	2.7E-01	1.3E+01	1.8E+00	3.4E+00
32774166	PCB 169	3900	3900	3.3E-08	3.8E-07	2.7E-04	1.3E-02	1.8E-03	3.4E-03
39635319	PCB 189	3.9	3.9	3.3E-05	3.8E-04	2.7E-01	1.3E+01	1.8E+00	3.4E+00
1746016	Dioxin-like PCB congeners (TEQ)	130000	130000	1.0E-09	1.1E-08	8.1E-06	3.8E-04	5.3E-05	1.0E-04

Notes:

1. Risk-based screening levels (RBSL) calculated following the methodology described in the PCB Notification Plan (AMEC, 2009a), and per the equations provided below.
2. CSFos and CSFis for Aroclor-1016 and dioxin TEQ obtained from OEHHa Toxicity Criteria Database (OEHHa, 2010). CSFos and CSFis for dioxin-like PCB congeners calculated by multiplying the CSFo and CSFi for dioxin TEQ by the congener-specific WHO 2005 TEFs presented in Tables 3 and 4.
3. RfDo for Aroclor-1016 obtained from U.S. EPA Integrated Risk Information System (IRIS) Database (U.S. EPA, 2010b). RfDi for Aroclor-1016 route-extrapolated from RfDo as recommended by Department of Toxic Substances Control (DTSC) (2009).  
RfDo for dioxin TEQ obtained from Agency for Toxic Substances Disease Registry (ATSDR), as cited in the U.S. EPA Regional Screening Levels Table (U.S. EPA, 2010c). RfDi calculated from reference concentration (RfC) provided by OEHHa/ARB (2010).  
RfDis and RfDos for dioxin-like PCB congeners calculated by multiplying the RfDo and RfDi for dioxin TEQ by the congener-specific WHO 2005 TEFs presented in Tables 3 and 4.
4. CAS No. for PCB 156.

Abbreviations:

CAS No. = chemical abstract service number  
mg/kg = milligrams per kilogram  
mg/kg-day = milligrams per kilogram - day

Equations:

$$RBSL_{soil-cancer} = \frac{TR \times BW \times AT_{ca}}{ED \times EF \times \left[ \left( \frac{IR_s \times CSF_o}{CF_{kg-mg}} \right) + \left( \frac{SAs \times SAF \times ABS \times CSF_o}{CF_{kg-mg}} \right) + \left( \frac{IHR_a \times CSF_i}{PEF} \right) \right]}$$

$$RBSL_{soil-noncancer} = \frac{THQ \times BW \times AT_{nc}}{ED \times EF \times \left[ \left( \frac{1}{RfD_o} \times \frac{IR_s}{CF_{kg-mg}} \right) + \left( \frac{1}{RfD_o} \times \frac{SAs \times SAF \times ABS}{CF_{kg-mg}} \right) + \left( \frac{1}{RfD_i} \times \frac{IHR_a}{PEF} \right) \right]}$$

TABLE 8

**REGRESSION ANALYSIS STATISTICS -  
DIOXIN TEQ VS. TOTAL PCBs (as Aroclors)**  
Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Regression	Number of Data Points	Slope of Regression Line	Intercept of Regression Line	Ratio of Dioxin TEQ to Total Aroclor Concentration (pg/g)/(μg/kg)			Total Aroclor Concentration Corresponding to 81 pg/g Dioxin TEQ <sup>4</sup>			F-Statistic	Critical Value of F for α = 0.05	Statistical Significance of F Statistic <sup>5</sup>
				95% UCL	Regression	95% LCL	95% UCL	Regression	95% LCL			
Untransformed Data												
Concrete	9	0.0230 <sup>1</sup>	0	0.0234	0 0230	0.0226	3,460	3,520	3,590	15437	5.32	5.77 x 10 <sup>-13</sup>
Soil	17	0.0107 <sup>1</sup>	0	0 014	0 0107	0.00748	5,800	7,500	10,800	48.8	4.49	4.40 x 10 <sup>-6</sup>
Combined Soil and Concrete	26	0.0229 <sup>1</sup>	0	0.0235	0 0229	0.0223	3,450	3,540	3,640	5874	4.24	3.33 x 10 <sup>-30</sup>
Log-Transformed Data												
Concrete	9	0.933 <sup>2</sup>	-2.59 <sup>3</sup>	NA	NA	NA	1,110	1,770	2,960	132	5.59	8 56 x 10 <sup>-6</sup>
Soil	17	1.08 <sup>2</sup>	-4.62 <sup>3</sup>	NA	NA	NA	1,850	4,380	20,100	22.9	4.54	2.49 x 10 <sup>-4</sup>
Combined Soil and Concrete	26	1.03 <sup>2</sup>	-3.92 <sup>3</sup>	NA	NA	NA	1,870	3,350	7,270	56.4	4.26	9.48 x 10 <sup>-8</sup>

**Notes**

1. Slope of the regression line has the units picograms per gram per microgram per kilogram ([pg/g]/[µg/kg]).
2. Slope of the regression line in the log-transformed domain (dimensionless).
3. Intercept of the regression line in the log-transformed domain (dimensionless).
4. Concentration in micrograms per kilogram (µg/kg).
5. Smaller values of the statistical significance correspond to greater strength for the regression.

**Abbreviations**

NA = Not applicable. The ratio of dioxin TEQ to total Aroclors cannot be estimated using a regression of log-transformed data.

TABLE 9

**POTENTIAL HUMAN HEALTH RISKS FROM DIOXIN-LIKE PCB CONGENERS VERSUS PCBs AS AROCLOR MIXTURES**  
Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Sample ID	Dioxin-Like PCB Congeners												Aroclor Mixtures				
	Concentrations reported in picograms per gram (pg/g)												Concentrations reported in micrograms per kilogram (µg/kg)				
	PCB 77	PCB 81	PCB 105	PCB 114	PCB 118	PCB 123	PCB 126	PCB 156, 157	PCB 167	PCB 169	PCB 189	Dioxin TEQ	Aroclor 1016	Aroclor 1232	Aroclor 1248	Aroclor 1254	Aroclor 1260
Concrete Samples																	
B-1-A	4600	<2171 <sup>1</sup>	14600	<1746	25200	<1546	<1647	1700	<1000	<677	<581	94.6	<20	<20	320	<20	280
C-12-A	190	<11.7	825	<45.5	1440	<39.5	<52.6	143	49	<15.9	19.9	2.96	<20	<20	110	<20	<20
C-14-A	131	<29.2	420	<72.4	920	<59.9	<100	242	98.6	<53.3	45.6	5.87	<20	<20	38	<20	74
DC-22-A	1010	<413	3310	<440	7990	405	<339	1300	1020	238	535	24.7	<20	<20	39	<20	130
DC-23-A	4060	<1546	13900	<1109	26200	<1135	<842	4340	2740	<536	1030	52.3	<20	<20	370	<20	810
DC-25-A	77.9	<32.6	260	<46.8	389	<39.3	<45.1	<46.6	58	<34.8	28.5	2.81	<20	<20	<20	<20	28
DC-52-A	659	<59.3	2220	99.3	2990	104	<82.4	216	136	<50.5	41.7	5.13	<20	<20	41	<20	33
DC-154-A	119000	4660	457000	28900	703000	11500	5960	44700	13200	<564	2630	656	<1000	<1000	12000	<1000	1400
DC-168-C	2730000	164000	10500000	842000	18100000	560000	124000	1530000	509000	<37214	302000	14250	<20000	<20000	390000	<20000	200000
Soil Samples																	
175-SS-01	51500	3130	246000	18700	320000	7200	3450	20900	5760	252	1210	377	<20	<20	3400	<20	500
176-SS-01	102000	4230	322000	23000	446000	13400	3090	22000	6090	103	937	349	<100	<100	20000	<100	860
177-SS-01	4080	<112	9320	503	14200	368	85.5	464	127	<4.26	17.4	9.79	<20	<20	130	<20	<20
178-SS-01	11900	<698	44200	1060	75200	8030	<925	7250	2450	<216	487	54.9	<20	<20	270	<20	180
179-SS-01	<1984	<1837	4220	<1834	6710	<1630	<1716	<1470	<1316	<1296	<967	106	<100	<100	130	<100	340
180-SS-01	1020	39.5	3570	232	6250	117	79.1	644	163	<11.4	36.1	8.53	<20	<20	65	<20	26
180-SS-02	382	16.4	1140	84.1	2150	50.4	17.1	128	37.3	<2.64	6.3	1.9	<20	<20	160	<20	<20
181-SS-01	959	43.3	3620	253	5950	141	61	597	191	9.68	66.7	6.82	<20	<20	54	56	30
182-SS-01	131000	<15391	565000	25400	1030000	22400	<8373	157000	56300	<5493	23100	573	<1000	<1000	14000	19000	26000
183-SS-01	32200	1160	111000	6490	169000	4620	1140	8740	2310	49.2	516	128	<20	<20	680	2300	350
184-SS-01	4.18	<2.37	36.6	<4.33	75.4	<3.59	<4.44	28.2	9.91	<4.28	2.82	0.29	<20	<20	<20	<20	<20
185-SS-01	5.74	<5.18	40.2	5.85	176	5.74	<2.72	6.58	<2.77	<2.39	1.25	0.18	<20	<20	190	<20	<20
186-SS-01	15.4	<4.97	40.4	<4.58	60.9	<4.31	<4.32	5.27	1.97	<1.58	<1.17	0.25	<20	<20	<20	<20	<20
187-SS-01	<60.1	<55	2200	<216	2740	<227	<306	4760	1540	<139	176	17.7	<20	<20	47	<20	51
188-SS-01	26.5	<2.6	99	6.87	156	4.03	<2.16	7.68	2.73	<1.09	<1.12	0.14	38	<20	<20	<20	<20
189-SS-01	41.9	<10.7	94	<8.38	198	<6.87	<8.89	8.55	<3.44	<3.3	<2	0.51	<20	610	<20	<20	<20
189-SS-02	690	<87.7	33900	1170	31800	1040	<47.6	931	169	<11.5	6.57	4.71	<100	1400	<100	<100	<100
UCL <sup>2</sup>	1164970	18126	4475566	362353	7706713	240452	13793	654961	218436	130	128797	6070	NA	716.4	166689	2460	86419
EPC <sup>3</sup>	1,200,000	18,000	4,500,000	360,000	7,700,000	240,000	14,000	650,000	220,000	130	130,000	6,100	38	720	170,000	2,500	86,000
Outdoor Commercial/ Industrial Worker Cancer-Based RB <sup>SL</sup> <sup>4</sup>	81,000	27,000	270,000	270,000	270,000	270,000	81	270,000	270,000	270	270,000	8.1	530	530	530	530	530
Predicted Lifetime Excess Cancer Risk - Outdoor Commercial/ Industrial Worker <sup>5</sup>	1.5E-05	6.7E-07	1.7E-05	1.3E-06	2.9E-05	8.9E-07	1.7E-04	2.4E-06	8.1E-07	4.8E-07	4.8E-07	7.5E-04	7.2E-08	1.4E-06	3.2E-04	4.7E-06	1.6E-04
									Cumulative Risk			2E-04	8E-04	Cumulative Risk			5E-04

**Notes:**

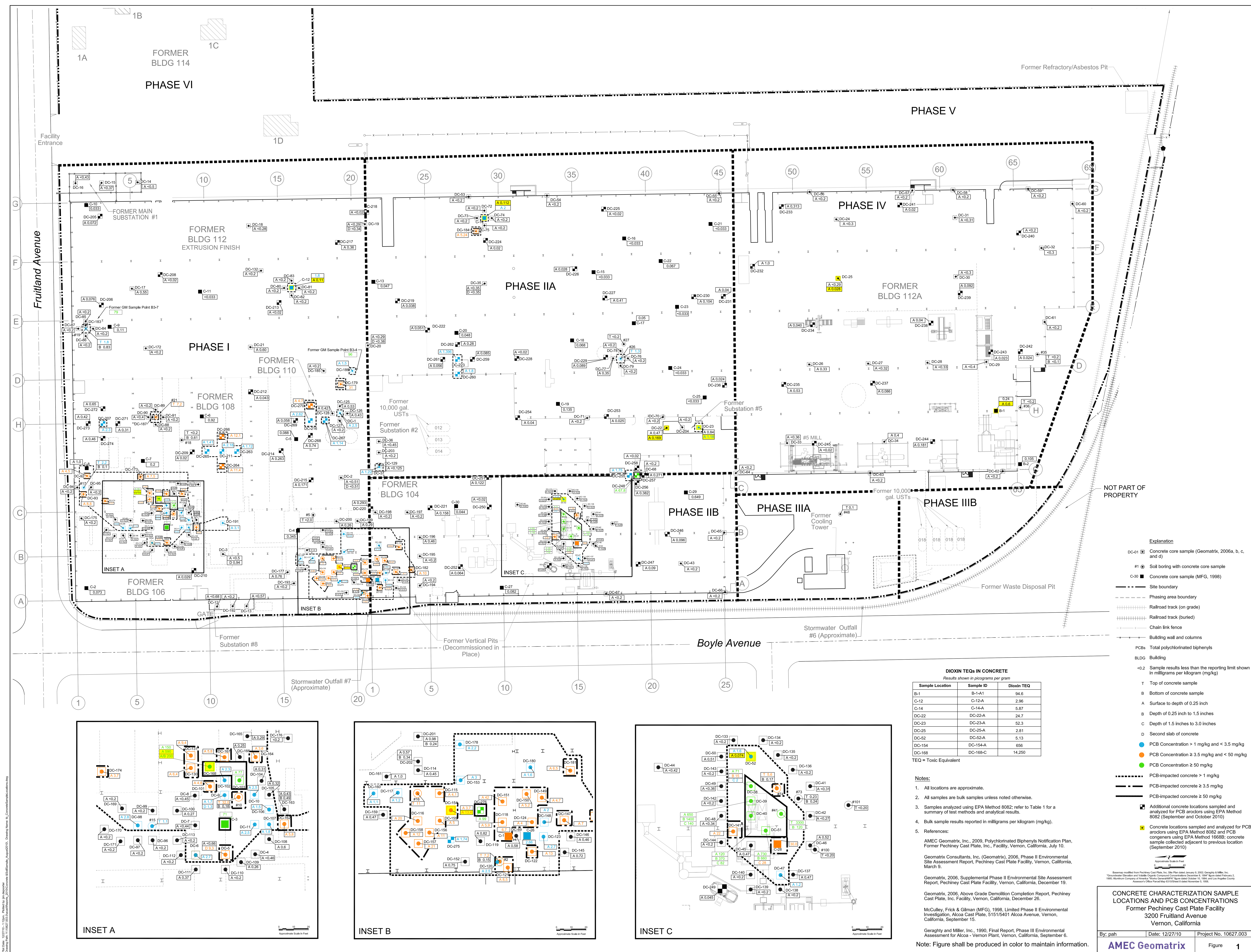
1. < = not detected at or above the reporting limit shown.
2. Upper confidence limit (UCL) concentration of the mean, calculated using U.S. EPA's ProUCL product (U.S. EPA, 2010d). ProUCL output provided in Supplement A.
3. Exposure point concentration selected as the lower of the maximum detected concentration and the UCL concentration of the mean (rounded to two significant figures).
4. Cancer-based risk-based screening levels (RBSLs) for outdoor commercial/industrial workers provided in Table 7.
5. Predicted lifetime excess cancer risks estimated by dividing each EPC by the cancer-based RBSL, and then multiplying the risk ratio by the target risk level of the RBSL (i.e.,  $1 \times 10^{-6}$ ).

**Abbreviations:**

EPC = exposure point concentration  
NA = Not applicable. UCL concentration not calculated for Aroclor 1016 (only one detected concentration).  
UCL = Upper Confidence Limit

## FIGURES

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- Explanation**
- DC-01 Concrete core sample (Geomatrix, 2006a, b, c, and d)
  - #1 Soil boring with concrete core sample
  - C-30 Concrete core sample (MFG, 1998)
  - Site boundary
  - Phasing area boundary
  - Railroad track (on grade)
  - Railroad track (buried)
  - Chain link fence
  - Building wall and columns
  - PCBs Total polychlorinated biphenyls
  - BLDG Building
  - <0.2 Sample results less than the reporting limit shown in milligrams per kilogram (mg/kg)
  - T Top of concrete sample
  - B Bottom of concrete sample
  - A Surface to depth of 0.25 inch
  - B Depth of 0.25 inch to 1.5 inches
  - C Depth of 1.5 inches to 3.0 inches
  - D Second slab of concrete
  - PCB Concentration > 1 mg/kg and < 3.5 mg/kg
  - PCB Concentration ≥ 3.5 mg/kg and < 50 mg/kg
  - PCB Concentration ≥ 50 mg/kg
  - PCB-impacted concrete > 1 mg/kg
  - PCB-impacted concrete ≥ 3.5 mg/kg
  - PCB-impacted concrete ≥ 50 mg/kg
  - Additional concrete locations sampled and analyzed for PCB and/or PCP and/or PCP congeners using EPA Method 8082 (September and October 2010)
  - Concrete locations sampled and analyzed for PCB and/or PCP and/or PCP congeners using EPA Method 1688B; concrete sample collected adjacent to previous location (September 2010)

**DIOXIN TEQs IN CONCRETE**  
Results shown in picograms per gram

Sample Location	Sample ID	Dioxin TEQ
B-1	B-1-A1	94.6
C-12	C-12-A	2.96
C-14	C-14-A	5.87
DC-22	DC-22-A	24.7
DC-23	DC-23-A	52.3
DC-25	DC-25-A	2.81
DC-52	DC-52-A	5.13
DC-154	DC-154-A	656
DC-168	DC-168-C	14,250

TEQ = Toxic Equivalent

**Notes:**

- All locations are approximate.
- All samples are bulk samples unless noted otherwise.
- Samples analyzed using EPA Method 8082; refer to Table 1 for a summary of test methods and analytical results.
- Bulk sample results reported in milligrams per kilogram (mg/kg).
- References:
  - AMEC Geomatrix, Inc., 2009, Polychlorinated Biphenyls Notification Plan, Former Pechiney Cast Plate, Inc., Facility, Vernon, California, July 10.
  - Geomatrix Consultants, Inc. (Geomatrix), 2006, Phase II Environmental Site Assessment Report, Pechiney Cast Plate Facility, Vernon, California, March 9.
  - Geomatrix, 2006, Supplemental Phase II Environmental Site Assessment Report, Pechiney Cast Plate Facility, Vernon, California, December 13.
  - Geomatrix, 2006, Above Grade Demolition Completion Report, Pechiney Cast Plate, Inc. Facility, Vernon, California, December 26.
  - McCulley, Frick & Gilman (MFG), 1998, Limited Phase II Environmental Investigation, Alcoa Cast Plate, 5151/5401 Alcoa Avenue, Vernon, California, September 15.
  - Geraghty and Miller, Inc., 1990, Final Report, Phase III Environmental Assessment for Alcoa - Vernon Plant, Vernon, California, September 6.

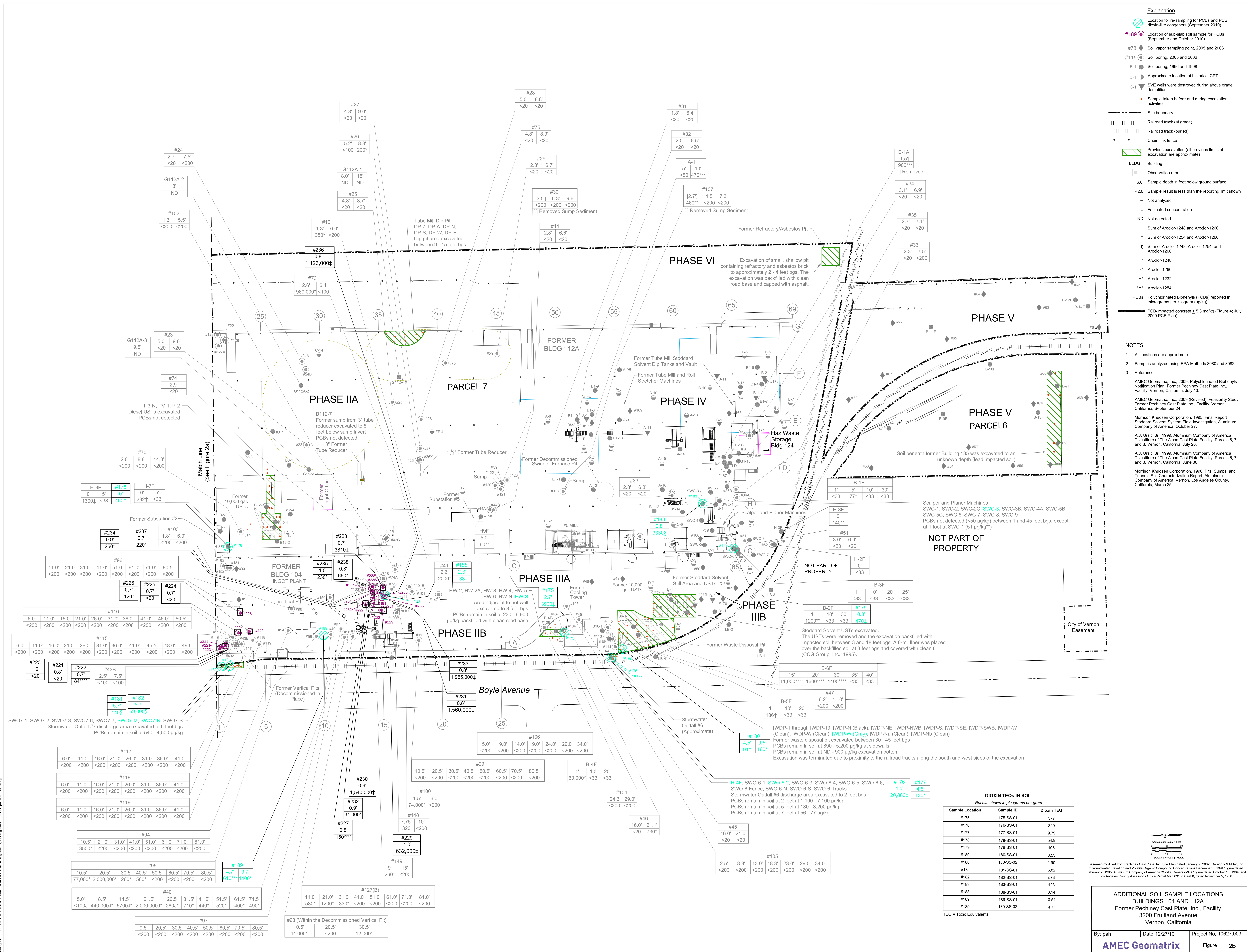
Note: Figure shall be produced in color to maintain information.

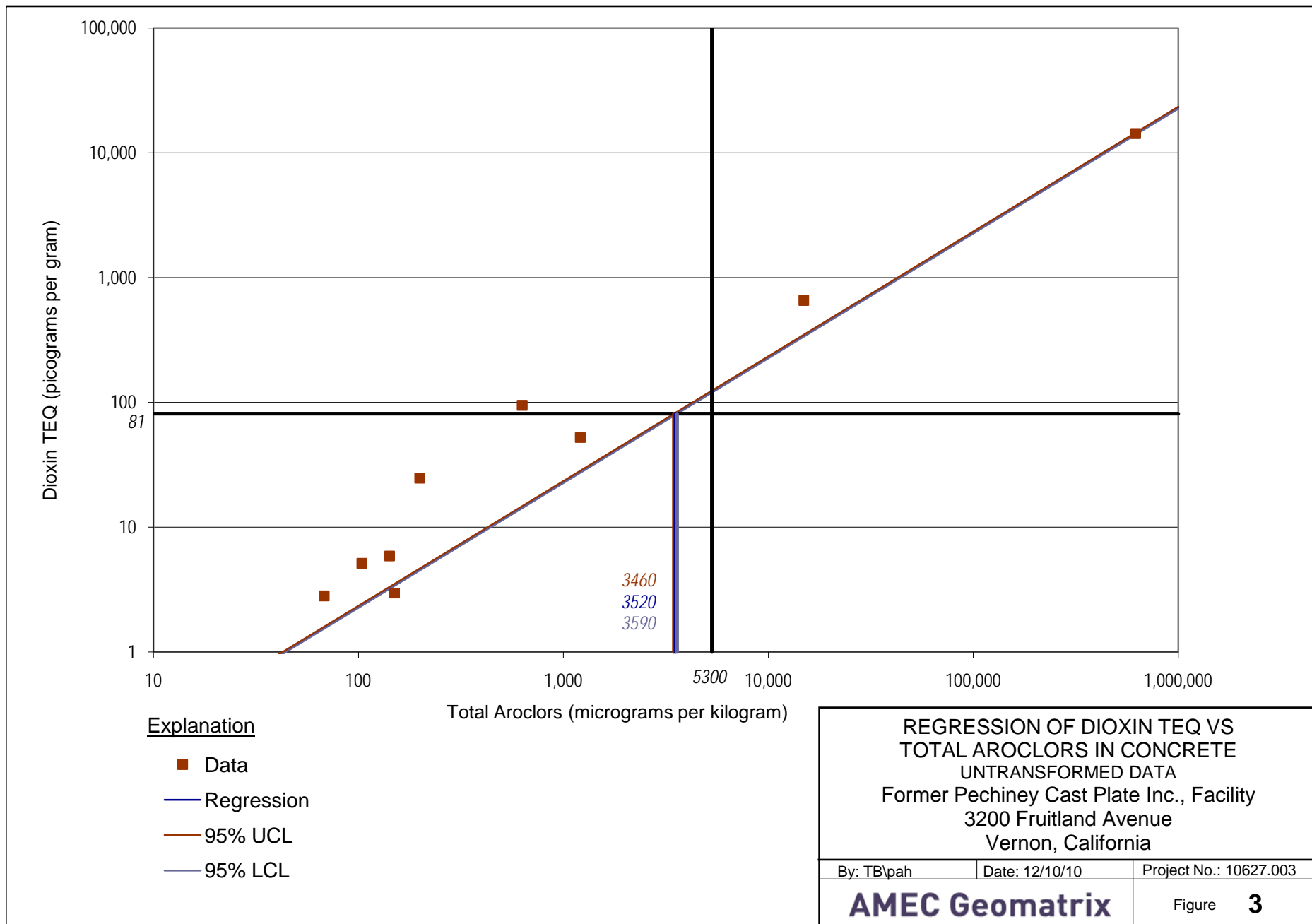
**CONCRETE CHARACTERIZATION SAMPLE LOCATIONS AND PCB CONCENTRATIONS**  
Former Pechiney Cast Plate Facility  
3200 Fruitland Avenue  
Vernon, California

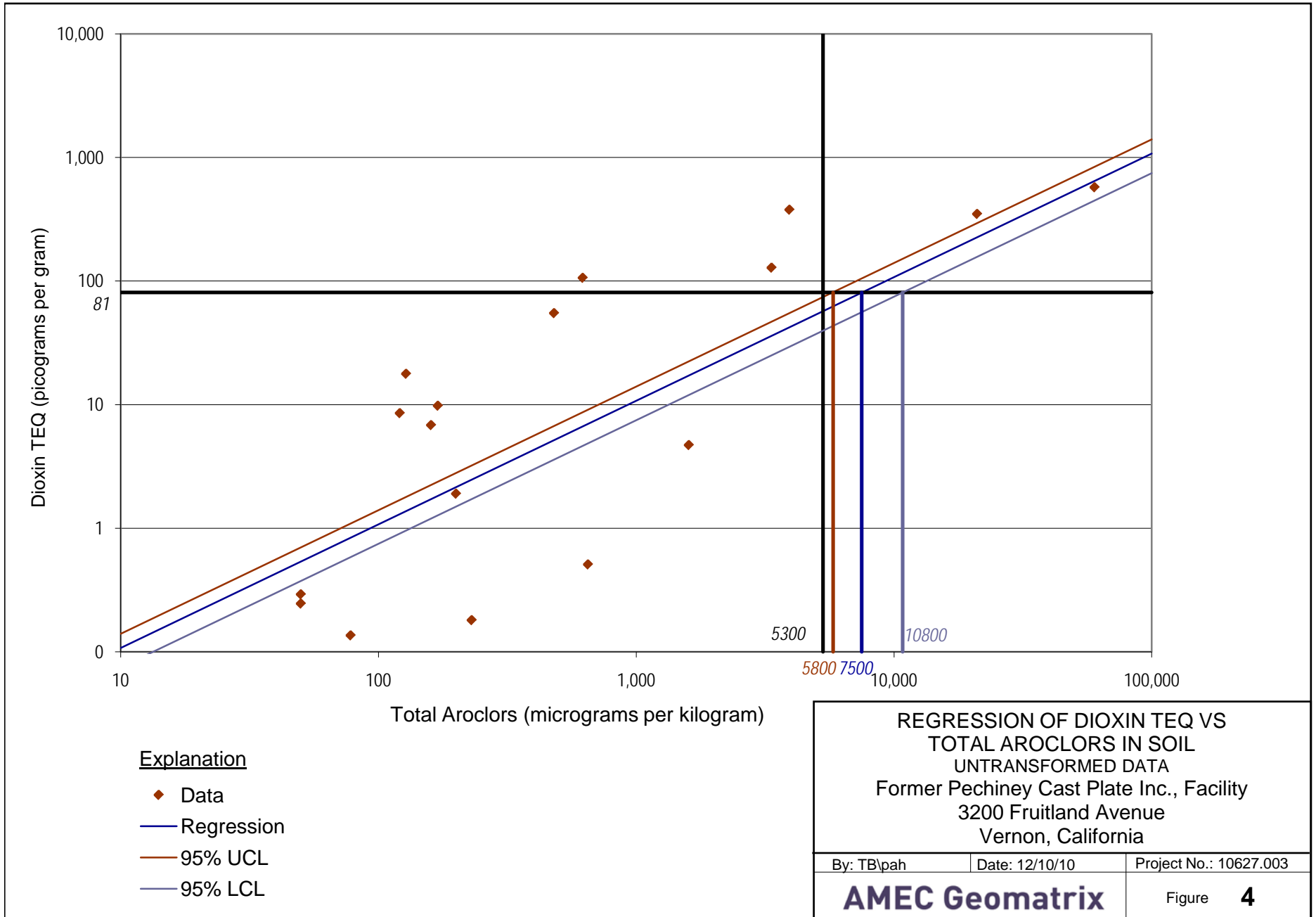
By: pah Date: 12/27/10 Project No. 10627.003

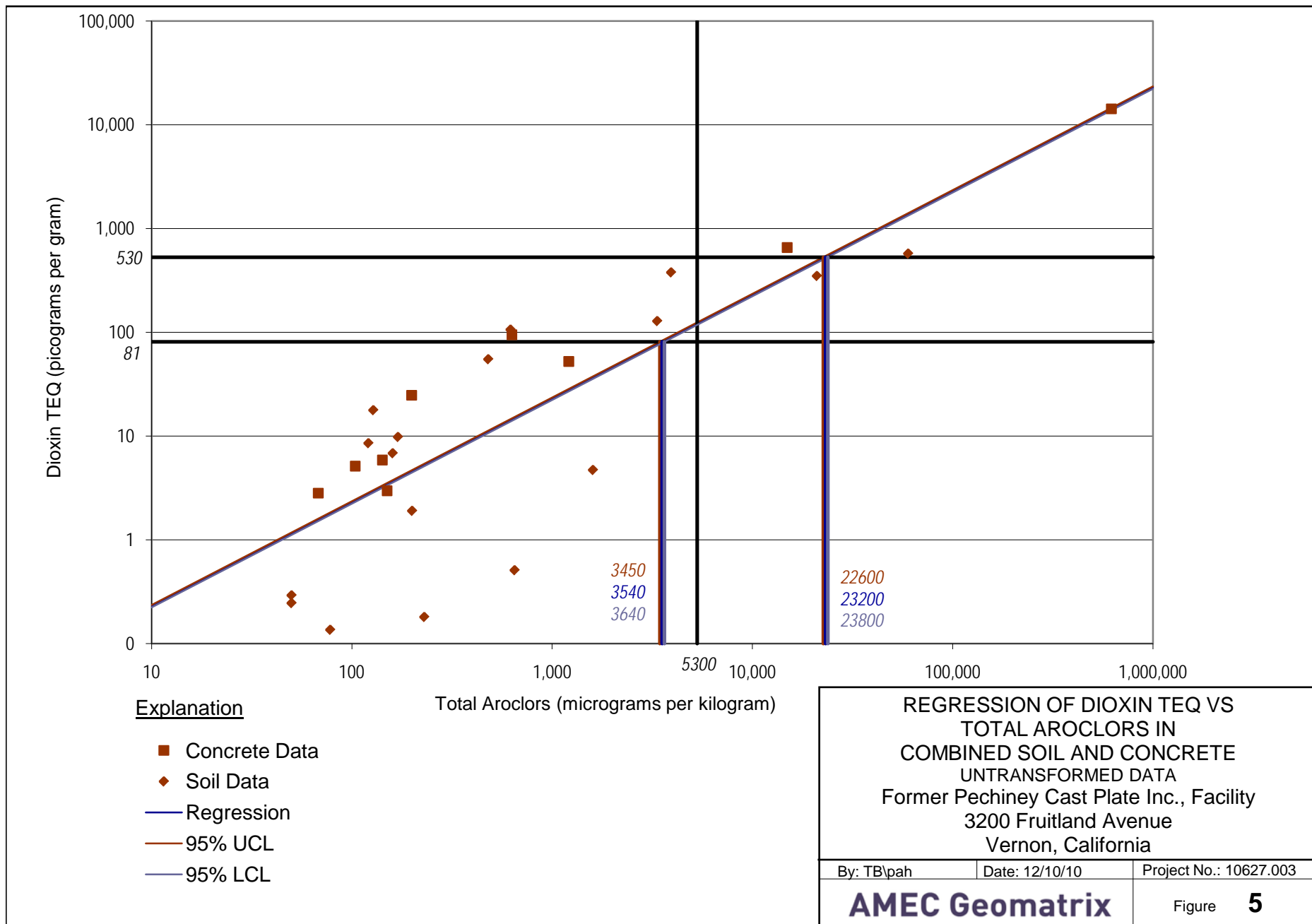
**AMEC Geomatrix** Figure 1

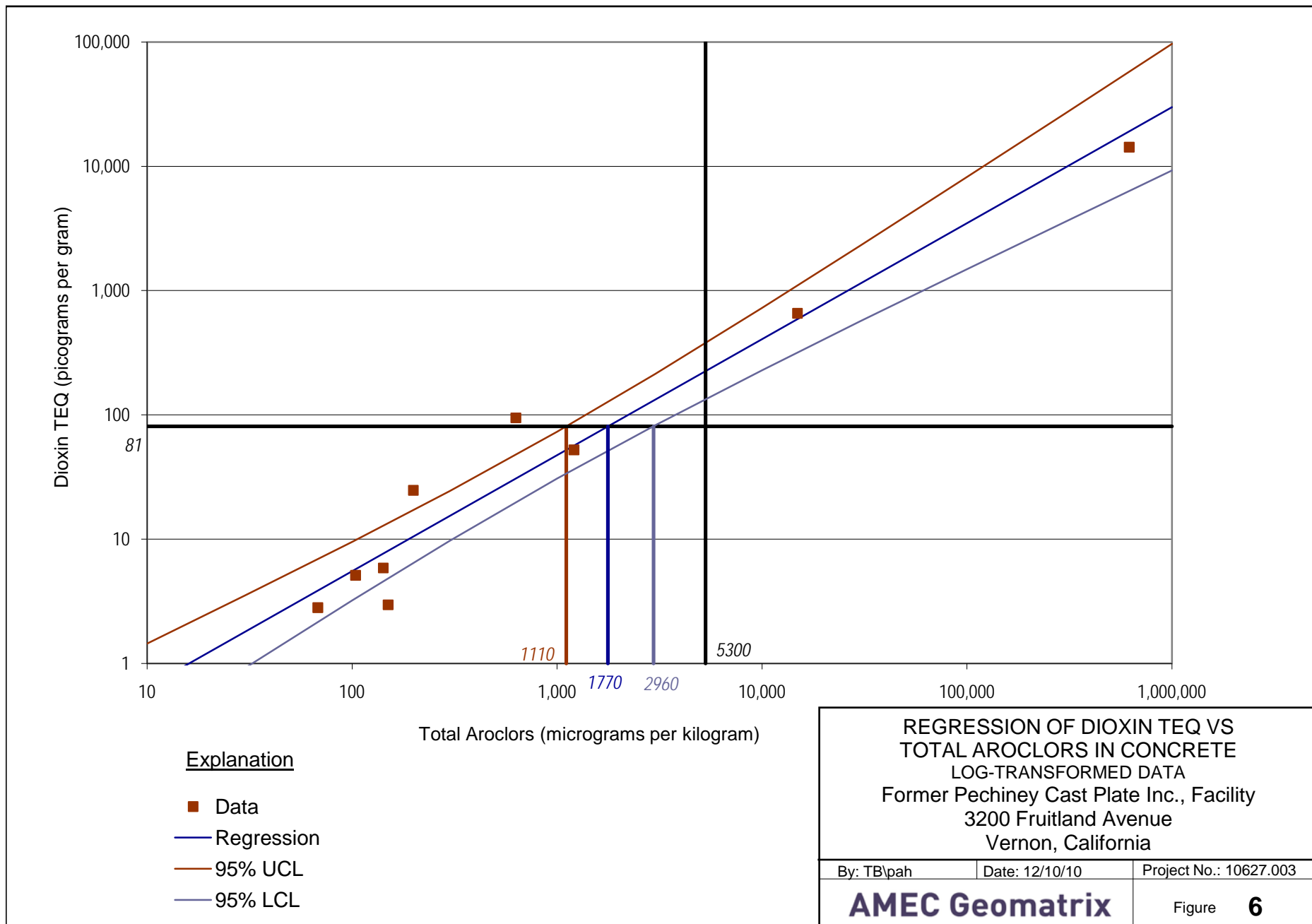


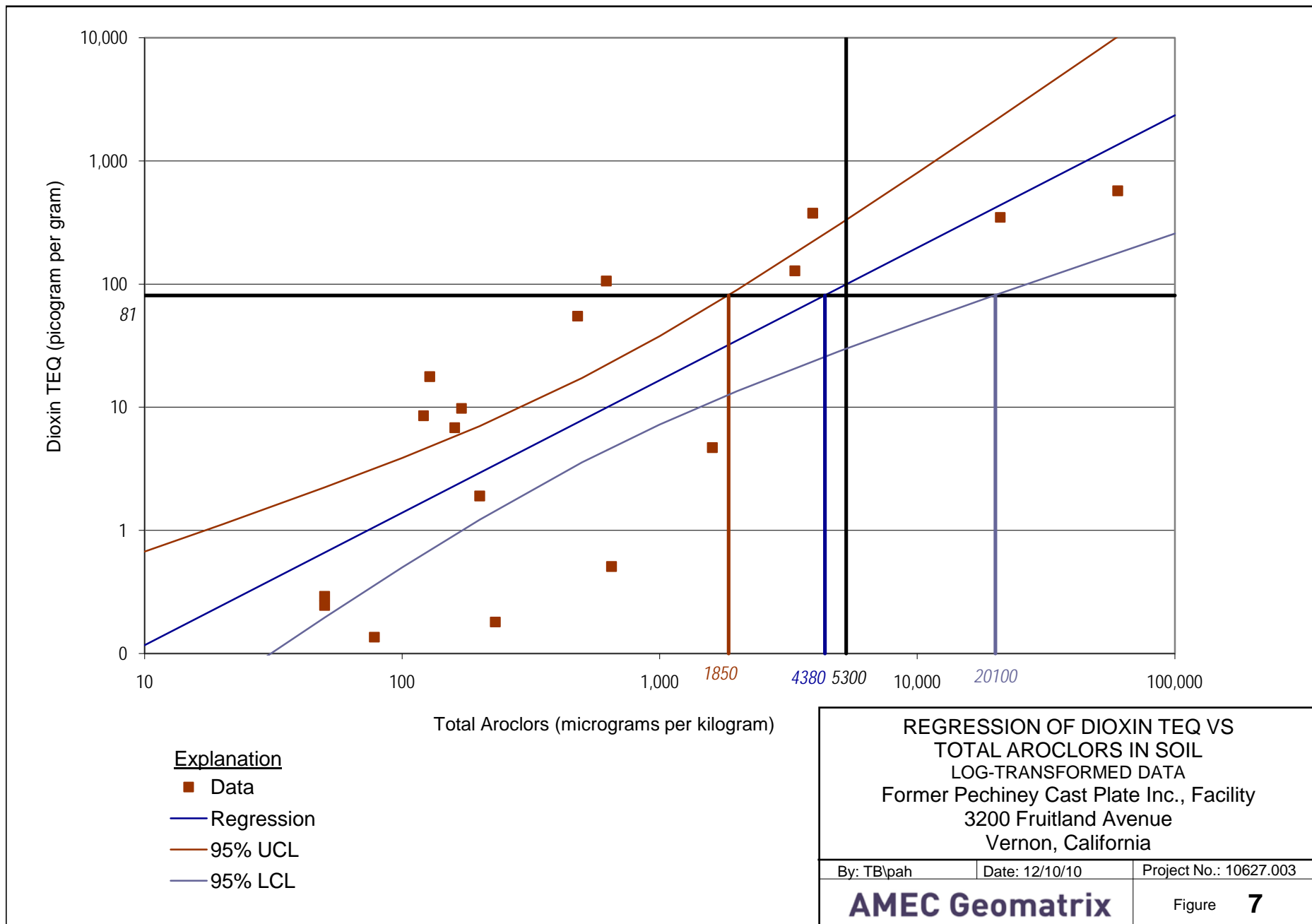


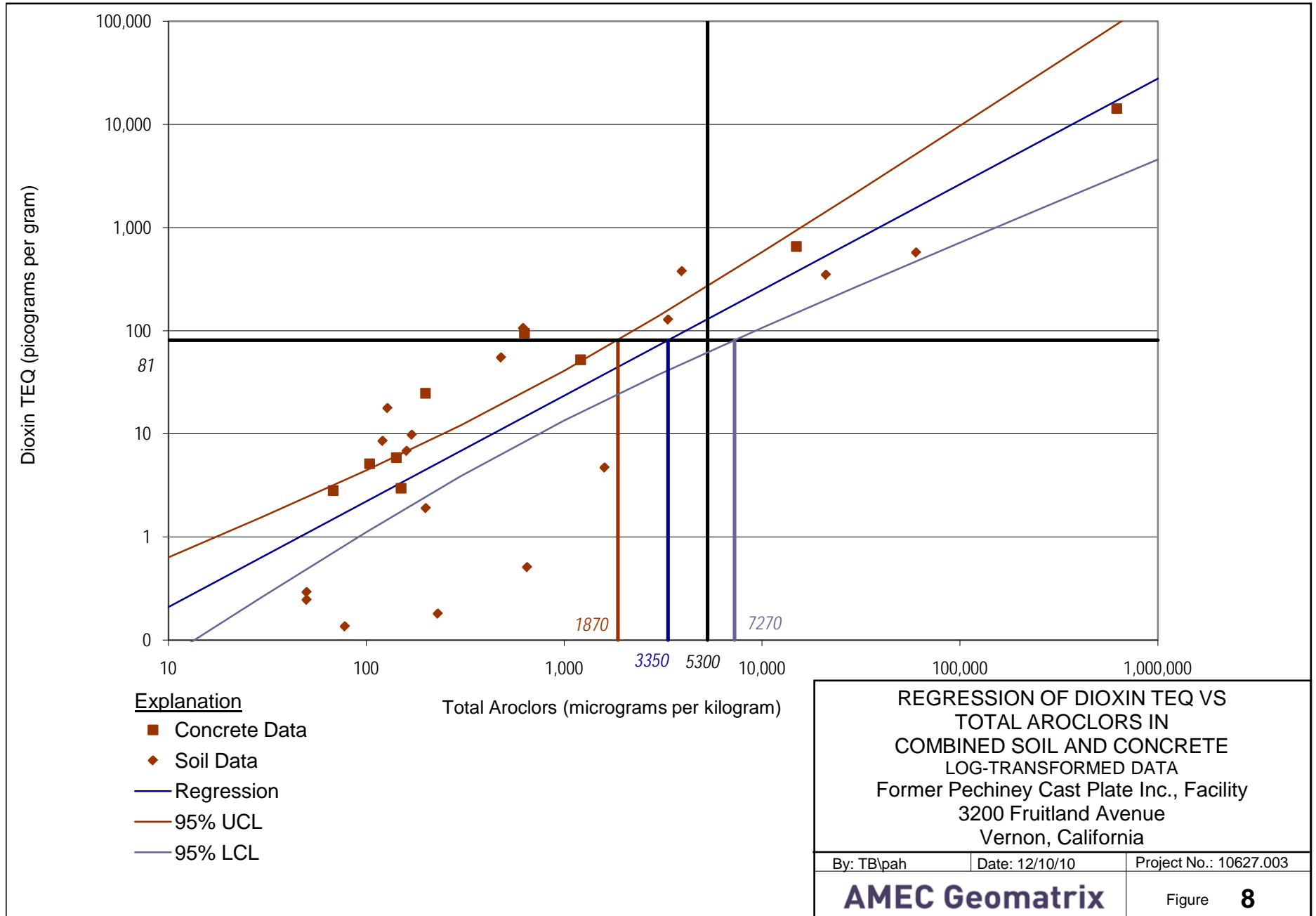












## SUPPLEMENT A

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## SUPPLEMENT A

### ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Concentrations in picograms per gram (pg/g)

<b>Dioxin TEQ</b>			
General Statistics			
Number of Valid Observations	26	Number of Distinct Observations	2600.00%
Raw Statistics		Log-transformed Statistics	
Minimum	0.14	Minimum of Log Data	-1.966
Maximum	14250	Maximum of Log Data	9.565
Mean	643.6	Mean of log Data	2.668
Median	9.16	SD of log Data	2.895
SD	2781		
Coefficient of Variation	4.321		
Skewness	5.065		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.241	Shapiro Wilk Test Statistic	0.97
Shapiro Wilk Critical Value	0.92	Shapiro Wilk Critical Value	0.92
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	1575	95% H-UCL	23216
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2188
95% Adjusted-CLT UCL (Chen-1995)	2120	97.5% Chebyshev (MVUE) UCL	2911
95% Modified-t UCL (Johnson-1978)	1666	99% Chebyshev (MVUE) UCL	4331
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.198	Data appear Lognormal at 5% Significance Level	
Theta Star	3254		
MLE of Mean	643.6		
MLE of Standard Deviation	1447		
nu star	10.28		
Approximate Chi Square Value (.05)	4.12	Nonparametric Statistics	
Adjusted Level of Significance	0.0398	95% CLT UCL	1541
Adjusted Chi Square Value	3.864	95% Jackknife UCL	1575
		95% Standard Bootstrap UCL	1523
Anderson-Darling Test Statistic	2.399	95% Bootstrap-t UCL	13204
Anderson-Darling 5% Critical Value	0.896	95% Hall's Bootstrap UCL	9062
Kolmogorov-Smirnov Test Statistic	0.234	95% Percentile Bootstrap UCL	1721
Kolmogorov-Smirnov 5% Critical Value	0.19	95% BCA Bootstrap UCL	2328
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	3021
		97.5% Chebyshev(Mean, Sd) UCL	4050
		99% Chebyshev(Mean, Sd) UCL	6070
Assuming Gamma Distribution			
95% Approximate Gamma UCL	1607		
95% Adjusted Gamma UCL	1713		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	6070
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.			

## SUPPLEMENT A

### ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Concentrations in picograms per gram (pg/g)

<b>PCB 77</b>			
General Statistics			
Number of Valid Data	26	Number of Detected Data	24
Number of Distinct Detected Data	24	Number of Non-Detect Data	2
		Percent Non-Detects	7.69%
Raw Statistics			
Minimum Detected	4.18	Log-transformed Statistics	
Maximum Detected	2730000	Minimum Detected	1.43
Mean of Detected	133148	Maximum Detected	14.82
SD of Detected	554548	Mean of Detected	7.191
Minimum Non-Detect	60.1	SD of Detected	3.493
Maximum Non-Detect	1984	Minimum Non-Detect	4.096
		Maximum Non-Detect	7.593
Note: Data have multiple DLs - Use of KM Method is recommended			
For all methods (except KM, DL/2, and ROS Methods),			
Observations < Largest ND are treated as NDs			
		Number treated as Non-Detect	16
		Number treated as Detected	10
		Single DL Non-Detect Percentage	61.54%
UCL Statistics			
Normal Distribution Test with Detected Values Only			
Shapiro Wilk Test Statistic	0.252	Lognormal Distribution Test with Detected Values Only	
5% Shapiro Wilk Critical Value	0.916	Shapiro Wilk Test Statistic	0.976
Data not Normal at 5% Significance Level		5% Shapiro Wilk Critical Value	0.916
		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution			
DL/2 Substitution Method			
Mean	122945	Assuming Lognormal Distribution	
SD	533123	DL/2 Substitution Method	
95% DL/2 (t) UCL	301538	Mean	7.034
		SD	3.432
		95% H-Stat (DL/2) UCL	34161125
Maximum Likelihood Estimate(MLE) Method			
MLE yields a negative mean			
	N/A	Log ROS Method	
		Mean in Log Scale	6.929
		SD in Log Scale	3.493
		Mean in Original Scale	122912
		SD in Original Scale	533131
		95% t UCL	301508
		95% Percentile Bootstrap UCL	328128
		95% BCA Bootstrap UCL	441151
Gamma Distribution Test with Detected Values Only			
k star (bias corrected)	0.172	Data Distribution Test with Detected Values Only	
Theta Star	775311	Data appear Lognormal at 5% Significance Level	
nu star	8.243		
A-D Test Statistic			
5% A-D Critical Value	2.009	Nonparametric Statistics	
K-S Test Statistic	0.909	Kaplan-Meier (KM) Method	
5% K-S Critical Value	0.198	Mean	122920
Data not Gamma Distributed at 5% Significance Level		SD	522776
		SE of Mean	104730
		95% KM (t) UCL	301814
		95% KM (z) UCL	295185
		95% KM (jackknife) UCL	301515
		95% KM (bootstrap t) UCL	2284932
		95% KM (BCA) UCL	340969
		95% KM (Percentile Bootstrap) UCL	325858
		95% KM (Chebyshev) UCL	579427
		97.5% KM (Chebyshev) UCL	776958
		99% KM (Chebyshev) UCL	1164970
Assuming Gamma Distribution			
Gamma ROS Statistics using Extrapolated Data			
Minimum	1.00E-12	Potential UCLs to Use	
Maximum	2730000	99% KM (Chebyshev) UCL	1164970
Mean	122906		
Median	824.5		
SD	533133		
k star	0.124		
Theta star	991365		
Nu star	6.447		
AppChi2	1.872		
95% Gamma Approximate UCL	423199		
95% Adjusted Gamma UCL	462165		
Note: DL/2 is not a recommended method.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
For additional insight, the user may want to consult a statistician.			

# SUPPLEMENT A

## ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Concentrations in picograms per gram (pg/g)

<b>PCB 81</b>			
<b>General Statistics</b>			
Number of Valid Data	26	Number of Detected Data	8
Number of Distinct Detected Data	8	Number of Non-Detect Data	18
		Percent Non-Detects	69.23%
<b>Raw Statistics</b>			
Minimum Detected	16.4	Log-transformed Statistics	
Maximum Detected	164000	Minimum Detected	2.797
Mean of Detected	22160	Maximum Detected	12.01
SD of Detected	57344	Mean of Detected	6.769
Minimum Non-Detect	2.37	SD of Detected	3.136
Maximum Non-Detect	15391	Minimum Non-Detect	0.863
		Maximum Non-Detect	9.642
<b>Note: Data have multiple DLs - Use of KM Method is recommended</b>			
<b>For all methods (except KM, DL/2, and ROS Methods),</b>			
<b>Observations &lt; Largest ND are treated as NDs</b>			
		Number treated as Non-Detect	25
		Number treated as Detected	1
		Single DL Non-Detect Percentage	96.15%
<b>Warning: There are only 8 Detected Values in this data</b>			
<b>Note: It should be noted that even though bootstrap may be performed on this data set</b>			
<b>the resulting calculations may not be reliable enough to draw conclusions</b>			
<b>It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.</b>			
<b>UCL Statistics</b>			
<b>Normal Distribution Test with Detected Values Only</b>			
Shapiro Wilk Test Statistic	0.448	Lognormal Distribution Test with Detected Values Only	
5% Shapiro Wilk Critical Value	0.818	Shapiro Wilk Test Statistic	0.916
Data not Normal at 5% Significance Level		5% Shapiro Wilk Critical Value	0.818
<b>Data appear Lognormal at 5% Significance Level</b>			
<b>Assuming Normal Distribution</b>			
<b>DL/2 Substitution Method</b>			
Mean	7251	Assuming Lognormal Distribution	
SD	32026	DL/2 Substitution Method	
95% DL/2 (t) UCL	17979	Mean	4.633
		SD	3.068
		95% H-Stat (DL/2) UCL	403312
<b>Maximum Likelihood Estimate(MLE) Method</b>			
<b>MLE method failed to converge properly</b>			
	N/A	Log ROS Method	
		Mean in Log Scale	1.631
		SD in Log Scale	3.946
		Mean in Original Scale	6819
		SD in Original Scale	32086
		95% t UCL	17568
		95% Percentile Bootstrap UCL	19395
		95% BCA Bootstrap UCL	25746
<b>Gamma Distribution Test with Detected Values Only</b>			
k star (bias corrected)	0.223	Data Distribution Test with Detected Values Only	
Theta Star	99389	Data Follow Appr. Gamma Distribution at 5% Significance Level	
nu star	3.567		
<b>A-D Test Statistic</b>			
5% A-D Critical Value	0.718	Nonparametric Statistics	
K-S Test Statistic	0.827	Kaplan-Meier (KM) Method	
5% K-S Critical Value	0.827	Mean	6860
Data follow Appr. Gamma Distribution at 5% Significance Level	0.322	SD	31455
		SE of Mean	6595
		95% KM (t) UCL	18126
		95% KM (z) UCL	17708
		95% KM (jackknife) UCL	17594
		95% KM (bootstrap t) UCL	216854
		95% KM (BCA) UCL	19490
		95% KM (Percentile Bootstrap) UCL	19378
		95% KM (Chebyshev) UCL	35608
		97.5% KM (Chebyshev) UCL	48047
		99% KM (Chebyshev) UCL	72481
<b>Assuming Gamma Distribution</b>			
<b>Gamma ROS Statistics using Extrapolated Data</b>			
Minimum	16.4	<b>Potential UCLs to Use</b>	
Maximum	164000	<b>95% KM (t) UCL</b>	
Mean	22531	<b>18126</b>	
Median	22207		
SD	30366		
k star	0.571		
Theta star	39430		
Nu star	29.71		
AppChi2	18.27		
95% Gamma Approximate UCL	36648		
95% Adjusted Gamma UCL	37878		
<b>Note: DL/2 is not a recommended method.</b>			
<b>Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.</b>			
<b>These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).</b>			
<b>For additional insight, the user may want to consult a statistician.</b>			

## SUPPLEMENT A

### ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Concentrations in picograms per gram (pg/g)

#### PCB 105

<b>General Statistics</b>			
Number of Valid Observations	26	Number of Distinct Observations	26
<b>Raw Statistics</b>		<b>Log-transformed Statistics</b>	
Minimum	36.6	Minimum of Log Data	3.6
Maximum	10500000	Maximum of Log Data	16.17
Mean	474578	Mean of log Data	8.549
Median	3595	SD of log Data	3.336
SD	2050390		
Coefficient of Variation	4.32		
Skewness	5.055		
<b>Relevant UCL Statistics</b>			
<b>Normal Distribution Test</b>		<b>Lognormal Distribution Test</b>	
Shapiro Wilk Test Statistic	0.243	Shapiro Wilk Test Statistic	0.964
Shapiro Wilk Critical Value	0.92	Shapiro Wilk Critical Value	0.92
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
<b>Assuming Normal Distribution</b>		<b>Assuming Lognormal Distribution</b>	
95% Student's-t UCL	1161446	95% H-UCL	89003719
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2390453
95% Adjusted-CLT UCL (Chen-1995)	1561942	97.5% Chebyshev (MVUE) UCL	3199645
95% Modified-t UCL (Johnson-1978)	1227884	99% Chebyshev (MVUE) UCL	4789144
<b>Gamma Distribution Test</b>		<b>Data Distribution</b>	
k star (bias corrected)	0.174	Data appear Lognormal at 5% Significance Level	
Theta Star	2733529		
MLE of Mean	474578		
MLE of Standard Deviation	1138978		
nu star	9.028		
Approximate Chi Square Value (.05)	3.344	<b>Nonparametric Statistics</b>	
Adjusted Level of Significance	0.0398	95% CLT UCL	1135997
Adjusted Chi Square Value	3.118	95% Jackknife UCL	1161446
		95% Standard Bootstrap UCL	1113593
Anderson-Darling Test Statistic	2.356	95% Bootstrap-t UCL	8518002
Anderson-Darling 5% Critical Value	0.909	95% Hall's Bootstrap UCL	6241994
Kolmogorov-Smirnov Test Statistic	0.246	95% Percentile Bootstrap UCL	1271181
Kolmogorov-Smirnov 5% Critical Value	0.191	95% BCA Bootstrap UCL	1717179
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	2227354
		97.5% Chebyshev(Mean, Sd) UCL	2985782
		99% Chebyshev(Mean, Sd) UCL	4475566
<b>Assuming Gamma Distribution</b>			
95% Approximate Gamma UCL	1281303		
95% Adjusted Gamma UCL	1373928		
<b>Potential UCL to Use</b>		<b>Use 99% Chebyshev (Mean, Sd) UCL</b>	<b>4475566</b>

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

# SUPPLEMENT A

## ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Concentrations in picograms per gram (pg/g)

### PCB 114

General Statistics			
Number of Valid Data	26	Number of Detected Data	15
Number of Distinct Detected Data	15	Number of Non-Detect Data	11
		Percent Non-Detects	42.31%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	5.85	Minimum Detected	1.766
Maximum Detected	842000	Maximum Detected	13.64
Mean of Detected	63194	Mean of Detected	7.111
SD of Detected	215716	SD of Detected	3.334
Minimum Non-Detect	4.33	Minimum Non-Detect	1.466
Maximum Non-Detect	1834	Maximum Non-Detect	7.514
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	20
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	6
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	76.92%
UCL Statistics		Lognormal Distribution Test with Detected Values Only	
Normal Distribution Test with Detected Values Only		Shapiro Wilk Test Statistic	
Shapiro Wilk Test Statistic	0.32	Shapiro Wilk Test Statistic	0.962
5% Shapiro Wilk Critical Value	0.881	5% Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distr bution		Assuming Lognormal Distr bution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	36564	Mean	5.752
SD	164513	SD	3.306
95% DL/2 (t) UCL	91675	95% H-Stat (DL/2) UCL	4560308
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	
	N/A	SD in Log Scale	
		Mean in Original Scale	
		SD in Original Scale	
		95% t UCL	
		95% Percentile Bootstrap UCL	
		95% BCA Bootstrap UCL	
Gamma Distr bution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.195	Data appear Lognormal at 5% Significance Level	
Theta Star	323801		
nu star	5.855		
A-D Test Statistic		Nonparametric Statistics	
5% A-D Critical Value	1.183	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.881	Mean	
5% K-S Critical Value	0.246	SD	
Data not Gamma Distr buted at 5% Significance Level		SE of Mean	
		95% KM (t) UCL	
		95% KM (z) UCL	
		95% KM (jackknife) UCL	
		95% KM (bootstrap t) UCL	
		95% KM (BCA) UCL	
		95% KM (Percentile Bootstrap) UCL	
		95% KM (Chebyshev) UCL	
		97.5% KM (Chebyshev) UCL	
		99% KM (Chebyshev) UCL	
Assuming Gamma Distribution		Potential UCLs to Use	
Gamma ROS Statistics using Extrapolated Data		99% KM (Chebyshev) UCL	
Minimum	1.00E-12		362353
Maximum	842000		
Mean	36458		
Median	45.49		
SD	164537		
k star	0.0685		
Theta star	531862		
Nu star	3.564		
AppChi2	0.558		
95% Gamma Approximate UCL	233052.000		
95% Adjusted Gamma UCL	265800.000		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). For additional insight, the user may want to consult a statistician.

## SUPPLEMENT A

### ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Concentrations in picograms per gram (pg/g)

#### PCB 118

<b>General Statistics</b>			
Number of Valid Observations	26	Number of Distinct Observations	26
<b>Raw Statistics</b>		<b>Log-transformed Statistics</b>	
Minimum	60.9	Minimum of Log Data	4.109
Maximum	18100000	Maximum of Log Data	16.71
Mean	806877	Mean of log Data	9.078
Median	6480	SD of log Data	3.239
SD	3535964		
Coefficient of Variation	4.382		
Skewness	5.059		
<b>Relevant UCL Statistics</b>			
<b>Normal Distribution Test</b>		<b>Lognormal Distribution Test</b>	
Shapiro Wilk Test Statistic	0.24	Shapiro Wilk Test Statistic	0.969
Shapiro Wilk Critical Value	0.92	Shapiro Wilk Critical Value	0.92
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
<b>Assuming Normal Distribution</b>		<b>Assuming Lognormal Distribution</b>	
95% Student's-t UCL	1991403	95% H-UCL	86929610
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	3153769
95% Adjusted-CLT UCL (Chen-1995)	2682620	97.5% Chebyshev (MVUE) UCL	4216636
95% Modified-t UCL (Johnson-1978)	2106065	99% Chebyshev (MVUE) UCL	6304432
<b>Gamma Distribution Test</b>		<b>Data Distribution</b>	
k star (bias corrected)	0.174	Data appear Lognormal at 5% Significance Level	
Theta Star	4648693		
MLE of Mean	806877		
MLE of Standard Deviation	1936730		
nu star	9.026		
Approximate Chi Square Value (.05)	3.342	<b>Nonparametric Statistics</b>	
Adjusted Level of Significance	0.0398	95% CLT UCL	1947516
Adjusted Chi Square Value	3.117	95% Jackknife UCL	1991403
		95% Standard Bootstrap UCL	1962157
Anderson-Darling Test Statistic	2.554	95% Bootstrap-t UCL	16828183
Anderson-Darling 5% Critical Value	0.909	95% Hall's Bootstrap UCL	13161327
Kolmogorov-Smirnov Test Statistic	0.266	95% Percentile Bootstrap UCL	2178341
Kolmogorov-Smirnov 5% Critical Value	0.191	95% BCA Bootstrap UCL	2934518
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	3829597
		97.5% Chebyshev(Mean, Sd) UCL	5137531
		99% Chebyshev(Mean, Sd) UCL	7706713
<b>Assuming Gamma Distribution</b>			
95% Approximate Gamma UCL	2178811		
95% Adjusted Gamma UCL	2336344		
<b>Potential UCL to Use</b>		<b>Use 99% Chebyshev (Mean, Sd) UCL</b>	<b>7706713</b>

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

# SUPPLEMENT A

## ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Concentrations in picograms per gram (pg/g)

PCB 123			
General Statistics			
Number of Valid Data	26	Number of Detected Data	16
Number of Distinct Detected Data	16	Number of Non-Detect Data	10
		Percent Non-Detects	38.46%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	4.03	Minimum Detected	1.394
Maximum Detected	560000	Maximum Detected	13.24
Mean of Detected	39337	Mean of Detected	6.793
SD of Detected	138995	SD of Detected	3.205
Minimum Non-Detect	3.59	Minimum Non-Detect	1.278
Maximum Non-Detect	1630	Maximum Non-Detect	7.396
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	19
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	7
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	73.08%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.307	Shapiro Wilk Test Statistic	0.966
5% Shapiro Wilk Critical Value	0.887	5% Shapiro Wilk Critical Value	0.887
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	24297	Mean	5.579
SD	109399	SD	3.266
95% DL/2 (t) UCL	60945	95% H-Stat (DL/2) UCL	3061277
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	
	N/A	SD in Log Scale	
		Mean in Original Scale	
		SD in Original Scale	
		95% t UCL	
		95% Percentile Bootstrap UCL	
		95% BCA Bootstrap UCL	
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.2	Data appear Lognormal at 5% Significance Level	
Theta Star	196503		
nu star	6.406		
A-D Test Statistic		Nonparametric Statistics	
5% A-D Critical Value	0.88	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.88	Mean	24226
5% K-S Critical Value	0.238	SD	107291
Data not Gamma Distributed at 5% Significance Level		SE of Mean	21731
		95% KM (t) UCL	61347
		95% KM (z) UCL	59972
		95% KM (jackknife) UCL	60880
		95% KM (bootstrap t) UCL	703664
		95% KM (BCA) UCL	67649
		95% KM (Percentile Bootstrap) UCL	66614
		95% KM (Chebyshev) UCL	118952
		97.5% KM (Chebyshev) UCL	159940
		99% KM (Chebyshev) UCL	240452
Assuming Gamma Distribution		Potential UCLs to Use	
Gamma ROS Statistics using Extrapolated Data		99% KM (Chebyshev) UCL	
Minimum	1.00E-12		240452
Maximum	560000		
Mean	24207		
Median	77.2		
SD	109420		
k star	0.0722		
Theta star	335183		
Nu star	3.755		
AppChi2	0.628		
95% Gamma Approximate UCL	144867.000		
95% Adjusted Gamma UCL	164570.000		
Note: DL/2 is not a recommended method.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
For additional insight, the user may want to consult a statistician.			

# SUPPLEMENT A

## ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Concentrations in picograms per gram (pg/g)

<b>PCB 126</b>			
<b>General Statistics</b>			
Number of Valid Data	26	Number of Detected Data	9
Number of Distinct Detected Data	9	Number of Non-Detect Data	17
		Percent Non-Detects	65.38%
<b>Raw Statistics</b>			
Minimum Detected	17.1	Log-transformed Statistics	
Maximum Detected	124000	Minimum Detected	2.839
Mean of Detected	15320	Maximum Detected	11.73
SD of Detected	40807	Mean of Detected	6.601
Minimum Non-Detect	2.16	SD of Detected	2.856
Maximum Non-Detect	8373	Minimum Non-Detect	0.77
		Maximum Non-Detect	9.033
<b>Note: Data have multiple DLs - Use of KM Method is recommended</b>			
<b>For all methods (except KM, DL/2, and ROS Methods),</b>			
<b>Observations &lt; Largest ND are treated as NDs</b>			
		Number treated as Non-Detect	25
		Number treated as Detected	1
		Single DL Non-Detect Percentage	96.15%
<b>Warning: There are only 9 Detected Values in this data</b>			
<b>Note: It should be noted that even though bootstrap may be performed on this data set</b>			
<b>the resulting calculations may not be reliable enough to draw conclusions</b>			
<b>It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.</b>			
<b>UCL Statistics</b>			
<b>Normal Distribution Test with Detected Values Only</b>			
Shapiro Wilk Test Statistic	0.432	Lognormal Distribution Test with Detected Values Only	
5% Shapiro Wilk Critical Value	0.829	Shapiro Wilk Test Statistic	0.934
Data not Normal at 5% Significance Level		5% Shapiro Wilk Critical Value	0.829
<b>Data appear Lognormal at 5% Significance Level</b>			
<b>Assuming Normal Distribution</b>			
<b>DL/2 Substitution Method</b>			
Mean	5582	Assuming Lognormal Distribution	
SD	24202	DL/2 Substitution Method	
95% DL/2 (t) UCL	13690	Mean	4.777
		SD	2.922
		95% H-Stat (DL/2) UCL	218795
<b>Maximum Likelihood Estimate(MLE) Method</b>			
<b>MLE method failed to converge properly</b>			
	N/A	Log ROS Method	
		Mean in Log Scale	2.457
		SD in Log Scale	3.562
		Mean in Original Scale	5304
		SD in Original Scale	24251
		95% t UCL	13428
		95% Percentile Bootstrap UCL	14724
		95% BCA Bootstrap UCL	19991
<b>Gamma Distribution Test with Detected Values Only</b>			
k star (bias corrected)	0.231	Data Distribution Test with Detected Values Only	
Theta Star	66179	Data appear Gamma Distributed at 5% Significance Level	
nu star	4.167		
<b>A-D Test Statistic</b>			
5% A-D Critical Value	0.831	Nonparametric Statistics	
K-S Test Statistic	0.831	Kaplan-Meier (KM) Method	
5% K-S Critical Value	0.305	Mean	5345
Data appear Gamma Distributed at 5% Significance Level		SD	23773
<b>Assuming Gamma Distribution</b>			
<b>Gamma ROS Statistics using Extrapolated Data</b>			
Minimum	17.1	SE of Mean	4945
Maximum	124000.000	95% KM (t) UCL	13793
Mean	15185.000	95% KM (z) UCL	13480
Median	14377.000	95% KM (jackknife) UCL	13445
SD	23115.000	95% KM (bootstrap t) UCL	144401
k star	0.546	95% KM (BCA) UCL	14865.000
Theta star	27826.000	95% KM (Percentile Bootstrap) UCL	14931.000
Nu star	28.380	95% KM (Chebyshev) UCL	26902.000
AppChi2	17.220	97.5% KM (Chebyshev) UCL	36230.000
95% Gamma Approximate UCL	25021.000	99% KM (Chebyshev) UCL	54552.000
95% Adjusted Gamma UCL	25884.000		
<b>Note: DL/2 is not a recommended method.</b>			
<b>Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.</b>			
<b>These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).</b>			
<b>For additional insight, the user may want to consult a statistician.</b>			

# SUPPLEMENT A

## ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Concentrations in picograms per gram (pg/g)

### PCB 156, 157

General Statistics			
Number of Valid Data	26	Number of Detected Data	24
Number of Distinct Detected Data	24	Number of Non-Detect Data	2
		Percent Non-Detects	7.69%
Raw Statistics			
Minimum Detected	5.27	Log-transformed Statistics	
Maximum Detected	1530000	Minimum Detected	1.662
Mean of Detected	75255	Maximum Detected	14.24
SD of Detected	311569	Mean of Detected	6.828
Minimum Non-Detect	46.6	SD of Detected	3.305
Maximum Non-Detect	1470	Minimum Non-Detect	3.842
		Maximum Non-Detect	7.293
Note: Data have multiple DLs - Use of KM Method is recommended			
For all methods (except KM, DL/2, and ROS Methods),			
Observations < Largest ND are treated as NDs			
		Number treated as Non-Detect	16
		Number treated as Detected	10
		Single DL Non-Detect Percentage	61.54%
UCL Statistics			
Normal Distribution Test with Detected Values Only			
Shapiro Wilk Test Statistic	0.258	Lognormal Distribution Test with Detected Values Only	
5% Shapiro Wilk Critical Value	0.916	Shapiro Wilk Test Statistic	0.971
Data not Normal at 5% Significance Level		5% Shapiro Wilk Critical Value	0.916
		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution			
DL/2 Substitution Method			
Mean	69495	Assuming Lognormal Distribution	
SD	299538	DL/2 Substitution Method	
95% DL/2 (t) UCL	169838	Mean	6.677
		SD	3.251
		95% H-Stat (DL/2) UCL	8458537
Maximum Likelihood Estimate(MLE) Method			
MLE yields a negative mean			
	N/A	Log ROS Method	
		Mean in Log Scale	6.58
		SD in Log Scale	3.305
		Mean in Original Scale	69471
		SD in Original Scale	299544
		95% t UCL	169816
		95% Percentile Bootstrap UCL	185588
		95% BCA Bootstrap UCL	256876
Gamma Distribution Test with Detected Values Only			
k star (bias corrected)	0.178	Data Distribution Test with Detected Values Only	
Theta Star	423697	Data appear Lognormal at 5% Significance Level	
nu star	8.525		
A-D Test Statistic			
5% A-D Critical Value	2.157	Nonparametric Statistics	
K-S Test Statistic	0.906	Kaplan-Meier (KM) Method	
5% K-S Critical Value	0.198	Mean	69478
Data not Gamma Distributed at 5% Significance Level		SD	293725
		SE of Mean	58843
		95% KM (t) UCL	169991
		95% KM (z) UCL	166267
		95% KM (jackknife) UCL	169823
		95% KM (bootstrap t) UCL	2211825
		95% KM (BCA) UCL	186483
		95% KM (Percentile Bootstrap) UCL	184427
		95% KM (Chebyshev) UCL	325970
		97.5% KM (Chebyshev) UCL	436954
		99% KM (Chebyshev) UCL	654961
Assuming Gamma Distribution			
Gamma ROS Statistics using Extrapolated Data			
Minimum	1.00E-12	Potential UCLs to Use	
Maximum	1530000	99% KM (Chebyshev) UCL	654961
Mean	69466		
Median	620.5		
SD	299545		
k star	0.127		
Theta star	547397		
Nu star	6.599		
AppChi2	1.953		
95% Gamma Approximate UCL	234691.000		
95% Adjusted Gamma UCL	255934.000		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). For additional insight, the user may want to consult a statistician.

# SUPPLEMENT A

## ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Concentrations in picograms per gram (pg/g)

### PCB 167

General Statistics			
Number of Valid Data	26	Number of Detected Data	22
Number of Distinct Detected Data	22	Number of Non-Detect Data	4
		Percent Non-Detects	15.38%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	1.97	Minimum Detected	0.678
Maximum Detected	509000	Maximum Detected	13.14
Mean of Detected	27339	Mean of Detected	6.093
SD of Detected	108249	SD of Detected	3.101
Minimum Non-Detect	2.77	Minimum Non-Detect	1.019
Maximum Non-Detect	1316	Maximum Non-Detect	7.182
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	17
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	9
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	65.38%
UCL Statistics		Lognormal Distribution Test with Detected Values Only	
Normal Distribution Test with Detected Values Only		Shapiro Wilk Test Statistic	0.975
Shapiro Wilk Test Statistic	0.271	5% Shapiro Wilk Critical Value	0.911
5% Shapiro Wilk Critical Value	0.911	Data appear Lognormal at 5% Significance Level	
Data not Normal at 5% Significance Level			
Assuming Normal Distr bution		Assuming Lognormal Distr bution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	23177	Mean	5.677
SD	99710	SD	3.235
95% DL/2 (t) UCL	56580	95% H-Stat (DL/2) UCL	2846963
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	5.5
	N/A	SD in Log Scale	3.236
		Mean in Original Scale	23136
		SD in Original Scale	99720
		95% t UCL	56542
		95% Percentile Bootstrap UCL	62018
		95% BCA Bootstrap UCL	98833
Gamma Distr bution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.187	Data appear Lognormal at 5% Significance Level	
Theta Star	146345		
nu star	8.22		
A-D Test Statistic		Nonparametric Statistics	
5% A-D Critical Value	2.161	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.9	Mean	23141
5% K-S Critical Value	0.9	SD	97782
Data not Gamma Distr buted at 5% Significance Level	0.206	SE of Mean	19628
		95% KM (t) UCL	56668
		95% KM (z) UCL	55426
		95% KM (jackknife) UCL	56546
		95% KM (bootstrap t) UCL	802484
		95% KM (BCA) UCL	62515
		95% KM (Percentile Bootstrap) UCL	61736
		95% KM (Chebyshev) UCL	108697
		97.5% KM (Chebyshev) UCL	145717
		99% KM (Chebyshev) UCL	218436
Assuming Gamma Distribution		Potential UCLs to Use	
Gamma ROS Statistics using Extrapolated Data		99% KM (Chebyshev) UCL	218436
Minimum	1.00E-12		
Maximum	509000		
Mean	23133		
Median	149.5		
SD	99720		
k star	0.105		
Theta star	219826		
Nu star	5.472		
AppChi2	1.376		
95% Gamma Approximate UCL	91974.000		
95% Adjusted Gamma UCL	101533.000		
Note: DL/2 is not a recommended method.			

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). For additional insight, the user may want to consult a statistician.

# SUPPLEMENT A

## ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Concentrations in picograms per gram (pg/g)

<b>PCB 169</b>			
General Statistics			
Number of Valid Data	26	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	21
		Percent Non-Detects	80.77%
Raw Statistics			
Minimum Detected	9.68	Log-transformed Statistics	
Maximum Detected	252	Minimum Detected	2.27
Mean of Detected	130.4	Maximum Detected	5.529
SD of Detected	109.9	Mean of Detected	4.36
Minimum Non-Detect	1.09	SD of Detected	1.348
Maximum Non-Detect	37214	Minimum Non-Detect	0.0862
		Maximum Non-Detect	10.52
Note: Data have multiple DLs - Use of KM Method is recommended			
For all methods (except KM, DL/2, and ROS Methods),			
Observations < Largest ND are treated as NDs			
		Number treated as Non-Detect	26
		Number treated as Detected	0
		Single DL Non-Detect Percentage	100.00%
Warning: There are only 5 Detected Values in this data			
Note: It should be noted that even though bootstrap may be performed on this data set			
the resulting calculations may not be reliable enough to draw conclusions			
It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.			
UCL Statistics			
Normal Distribution Test with Detected Values Only			
Shapiro Wilk Test Statistic	0.884	Lognormal Distribution Test with Detected Values Only	
5% Shapiro Wilk Critical Value	0.762	Shapiro Wilk Test Statistic	0.893
Data appear Normal at 5% Significance Level		5% Shapiro Wilk Critical Value	0.762
Data appear Lognormal at 5% Significance Level			
Assuming Normal Distribution			
DL/2 Substitution Method			
Mean	916.1	Assuming Lognormal Distribution	
SD	3648	DL/2 Substitution Method	
95% DL/2 (t) UCL	2138	Mean	3.406
		SD	2.687
		95% H-Stat (DL/2) UCL	17836
Maximum Likelihood Estimate(MLE) Method			
MLE method failed to converge properly			
	N/A	Log ROS Method	
		Mean in Log Scale	1.409
		SD in Log Scale	1.613
		Mean in Original Scale	26.87
		SD in Original Scale	67.71
		95% t UCL	49.55
		95% Percentile Bootstrap UCL	49.97
		95% BCA Bootstrap UCL	58.59
Gamma Distribution Test with Detected Values Only			
k star (bias corrected)	0.58	Data Distribution Test with Detected Values Only	
Theta Star	224.6	Data appear Normal at 5% Significance Level	
nu star	5.804		
A-D Test Statistic			
5% A-D Critical Value	0.309	Nonparametric Statistics	
K-S Test Statistic	0.69	Kaplan-Meier (KM) Method	
5% K-S Critical Value	0.69	Mean	41.03
Data appear Gamma Distributed at 5% Significance Level	0.364	SD	71.77
		SE of Mean	18.08
		95% KM (t) UCL	71.92
		95% KM (z) UCL	70.77
		95% KM (jackknife) UCL	71.77
		95% KM (bootstrap t) UCL	71.59
		95% KM (BCA) UCL	239
		95% KM (Percentile Bootstrap) UCL	130
		95% KM (Chebyshev) UCL	119.9
		97.5% KM (Chebyshev) UCL	154
		99% KM (Chebyshev) UCL	221
Assuming Gamma Distribution			
Gamma ROS Statistics using Extrapolated Data			
Minimum	1.00E-12	Potential UCLs to Use	
Maximum	252.000	95% KM (t) UCL	71.92
Mean	25.070	95% KM (Percentile Bootstrap) UCL	130
Median	0.000		
SD	68.390		
k star	0.058		
Theta star	433.700		
Nu star	3.006		
AppChi2	0.374		
95% Gamma Approximate UCL	201.400		
95% Adjusted Gamma UCL	232.100		
Note: DL/2 is not a recommended method.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
For additional insight, the user may want to consult a statistician.			

# SUPPLEMENT A

## ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Concentrations in picograms per gram (pg/g)

PCB 189			
General Statistics			
Number of Valid Data	26	Number of Detected Data	21
Number of Distinct Detected Data	21	Number of Non-Detect Data	5
		Percent Non-Detects	19.23%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	1.25	Minimum Detected	0.223
Maximum Detected	302000	Maximum Detected	12.62
Mean of Detected	15852	Mean of Detected	4.992
SD of Detected	65754	SD of Detected	3.026
Minimum Non-Detect	1.12	Minimum Non-Detect	0.113
Maximum Non-Detect	967	Maximum Non-Detect	6.874
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	21
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	5
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	80.77%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.257	Shapiro Wilk Test Statistic	0.956
5% Shapiro Wilk Critical Value	0.908	5% Shapiro Wilk Critical Value	0.908
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	12833	Mean	4.445
SD	59150	SD	3.248
95% DL/2 (t) UCL	32648	95% H-Stat (DL/2) UCL	892290
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	
	N/A	SD in Log Scale	
		Mean in Original Scale	
		SD in Original Scale	
		95% t UCL	
		95% Percentile Bootstrap UCL	
		95% BCA Bootstrap UCL	
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.171	Data appear Lognormal at 5% Significance Level	
Theta Star	92757		
nu star	7.178		
A-D Test Statistic		Nonparametric Statistics	
5% A-D Critical Value	0.905	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.905	Mean	
5% K-S Critical Value	0.211	SD	
Data not Gamma Distributed at 5% Significance Level		SE of Mean	
		95% KM (t) UCL	
		95% KM (z) UCL	
		95% KM (jackknife) UCL	
		95% KM (bootstrap t) UCL	
		95% KM (BCA) UCL	
		95% KM (Percentile Bootstrap) UCL	
		95% KM (Chebyshev) UCL	
		97.5% KM (Chebyshev) UCL	
		99% KM (Chebyshev) UCL	
Assuming Gamma Distribution		Potential UCLs to Use	
Gamma ROS Statistics using Extrapolated Data		99% KM (Chebyshev) UCL	
Minimum	1.25		128797
Maximum	302000		
Mean	16192		
Median	501.5		
SD	58816		
k star	0.198		
Theta star	81586		
Nu star	10.32		
AppChi2	4.143		
95% Gamma Approximate UCL	40336.000		
95% Adjusted Gamma UCL	42993.000		
Note: DL/2 is not a recommended method.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). For additional insight, the user may want to consult a statistician.			

# SUPPLEMENT A

## ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Concentrations in picograms per gram (pg/g)

<b>Aroclor 1232</b>			
General Statistics			
Number of Valid Data	26	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	24
		Percent Non-Detects	92.31%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	610	Minimum Detected	6.413
Maximum Detected	1400	Maximum Detected	7.244
Mean of Detected	1005	Mean of Detected	6.829
SD of Detected	558.6	SD of Detected	0.587
Minimum Non-Detect	20	Minimum Non-Detect	2.996
Maximum Non-Detect	20000	Maximum Non-Detect	9.903
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	26
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%
Warning: Data set has only 2 Distinct Detected Values.			
This may not be adequate enough to compute meaningful and reliable test statistics and estimates.			
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).			
Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.			
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.			
Those methods will return a 'N/A' value on your output display!			
It is necessary to have 4 or more Distinct Values for bootstrap methods.			
However, results obtained using 4 to 9 distinct values may not be reliable.			
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.			
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	N/A	Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	511.5	Mean	3.341
SD	1960	SD	1.968
95% DL/2 (t) UCL	1168	95% H-Stat (DL/2) UCL	927.8
Maximum Likelihood Estimate (MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% t UCL	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	N/A	Data do not follow a Discernable Distribution (0.05)	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	Nonparametric Statistics	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	641.6
5% K-S Critical Value	N/A	SD	154.8
Data not Gamma Distributed at 5% Significance Level		SE of Mean	43.79
Assuming Gamma Distribution		95% KM (t) UCL	716.4
Gamma ROS Statistics using Extrapolated Data		95% KM (z) UCL	713.6
Minimum	N/A	95% KM (jackknife) UCL	1161
Maximum	N/A	95% KM (bootstrap t) UCL	N/A
Mean	N/A	95% KM (BCA) UCL	1400
Median	N/A	95% KM (Percentile Bootstrap) UCL	N/A
SD	N/A	95% KM (Chebyshev) UCL	832.5
k star	N/A	97.5% KM (Chebyshev) UCL	915
Theta star	N/A	99% KM (Chebyshev) UCL	1077
Nu star	N/A	Potential UCLs to Use	
AppChi2	N/A	95% KM (t) UCL	716.4
95% Gamma Approximate UCL	N/A	95% KM (% Bootstrap) UCL	N/A
95% Adjusted Gamma UCL	N/A		
Note: DL/2 is not a recommended method.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
For additional insight, the user may want to consult a statistician.			

# SUPPLEMENT A

## ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Concentrations in picograms per gram (pg/g)

### Aroclor 1248

General Statistics			
Number of Valid Data	26	Number of Detected Data	20
Number of Distinct Detected Data	19	Number of Non-Detect Data	6
		Percent Non-Detects	23.08%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	38	Minimum Detected	3.638
Maximum Detected	390000	Maximum Detected	12.87
Mean of Detected	22102	Mean of Detected	6.072
SD of Detected	86779	SD of Detected	2.57
Minimum Non-Detect	20	Minimum Non-Detect	2.996
Maximum Non-Detect	100	Maximum Non-Detect	4.605
Note: Data have multiple DLs - Use of KM Method is recommended For all methods (except KM, DL/2, and ROS Methods), Observations < Largest ND are treated as NDs		Number treated as Non-Detect	12
		Number treated as Detected	14
		Single DL Non-Detect Percentage	46.15%
UCL Statistics		Lognormal Distribution Test with Detected Values Only	
Normal Distribution Test with Detected Values Only		Shapiro Wilk Test Statistic	0.839
Shapiro Wilk Test Statistic	0.273	5% Shapiro Wilk Critical Value	0.905
5% Shapiro Wilk Critical Value	0.905	Data not Lognormal at 5% Significance Level	
Data not Normal at 5% Significance Level			
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	17006	Mean	5.264
SD	76245	SD	2.714
95% DL/2 (t) UCL	42547	95% H-Stat (DL/2) UCL	129784
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
MLE yields a negative mean	N/A	Mean in Log Scale	4.808
		SD in Log Scale	3.304
		Mean in Original Scale	17002
		SD in Original Scale	76246
		95% t UCL	42544
		95% Percentile Bootstrap UCL	46737
		95% BCA Bootstrap UCL	62122
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.194	Data do not follow a Discernable Distribution (0.05)	
Theta Star	114012		
nu star	7.754		
A-D Test Statistic		Nonparametric Statistics	
5% A-D Critical Value	0.893	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.893	Mean	17011
5% K-S Critical Value	0.215	SD	74763
Data not Gamma Distributed at 5% Significance Level		SE of Mean	15043
		95% KM (t) UCL	42707
		95% KM (z) UCL	41755
		95% KM (jackknife) UCL	42552
		95% KM (bootstrap t) UCL	387404
		95% KM (BCA) UCL	47403
		95% KM (Percentile Bootstrap) UCL	46383
		95% KM (Chebyshev) UCL	82583
		97.5% KM (Chebyshev) UCL	110956
		99% KM (Chebyshev) UCL	166689
Assuming Gamma Distribution		Potential UCLs to Use	
Gamma ROS Statistics using Extrapolated Data		99% KM (Chebyshev) UCL	166689
Minimum	1.00E-12		
Maximum	390000		
Mean	17002		
Median	120		
SD	76246		
k star	0.0907		
Theta star	187420		
Nu star	4.717		
AppChi2	1.024		
95% Gamma Approximate UCL	78334		
95% Adjusted Gamma UCL	87418		
Note: DL/2 is not a recommended method.			

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). For additional insight, the user may want to consult a statistician.

# SUPPLEMENT A

## ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA

Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Concentrations in picograms per gram (pg/g)

<b>Aroclor 1254</b>			
General Statistics			
Number of Valid Data	26	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	23
		Percent Non-Detects	88.46%
Raw Statistics			
Minimum Detected	56	Log-transformed Statistics	
Maximum Detected	19000	Minimum Detected	4.025
Mean of Detected	7119	Maximum Detected	9.852
SD of Detected	10351	Mean of Detected	7.206
Minimum Non-Detect	20	SD of Detected	2.95
Maximum Non-Detect	20000	Minimum Non-Detect	2.996
		Maximum Non-Detect	9.903
Note: Data have multiple DLs - Use of KM Method is recommended			
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Non-Detect	26
Observations < Largest ND are treated as NDs		Number treated as Detected	0
		Single DL Non-Detect Percentage	100.00%
Warning: There are only 3 Distinct Detected Values in this data set			
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.			
Those methods will return a 'N/A' value on your output display!			
It is necessary to have 4 or more Distinct Values for bootstrap methods.			
However, results obtained using 4 to 9 distinct values may not be reliable.			
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.			
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.837	Shapiro Wilk Test Statistic	0.975
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution			
DL/2 Substitution Method		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1238	Mean	3.47
SD	4131	SD	2.235
95% DL/2 (t) UCL	2622	95% H-Stat (DL/2) UCL	2786
Maximum Likelihood Estimate(MLE) Method			
MLE method failed to converge, error	N/A	Log ROS Method	
		Mean in Log Scale	-6.534
		SD in Log Scale	7.554
		Mean in Original Scale	821.6
		SD in Original Scale	3735
		95% t UCL	2073
		95% Percentile Bootstrap UCL	2197
		95% BCA Bootstrap UCL	3105
Gamma Distribution Test with Detected Values Only			
K-S Test Statistic (bias corrected)	N/A	Data Distribution Test with Detected Values Only	
Theta Star	N/A	Data appear Normal at 5% Significance Level	
Nu Star	N/A		
A-D Test Statistic			
5% A-D Critical Value	N/A	Nonparametric Statistics	
K-S Test Statistic	N/A	Kaplan-Meier (KM) Method	
5% K-S Critical Value	N/A	Mean	903.5
Data not Gamma Distributed at 5% Significance Level		SD	3720
		SE of Mean	911.2
		95% KM (t) UCL	2460
		95% KM (z) UCL	2402
		95% KM (jackknife) UCL	2601
		95% KM (bootstrap t) UCL	5445
		95% KM (BCA) UCL	N/A
		95% KM (Percentile Bootstrap) UCL	19000
		95% KM (Chebyshev) UCL	4875
		97.5% KM (Chebyshev) UCL	6594
		99% KM (Chebyshev) UCL	9970
Assuming Gamma Distribution			
Gamma ROS Statistics using Extrapolated Data		Potential UCLs to Use	
Minimum	N/A	95% KM (t) UCL	2460
Maximum	N/A	95% KM (Percentile Bootstrap) UCL	19000
Mean	N/A		
Median	N/A		
SD	N/A		
K-S Test Statistic	N/A		
Theta Star	N/A		
Nu Star	N/A		
AppChi2	N/A		
95% Gamma Approximate UCL	N/A		
95% Adjusted Gamma UCL	N/A		
Note: DL/2 is not a recommended method.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
For additional insight, the user may want to consult a statistician.			

**SUPPLEMENT A**  
**ProUCL OUTPUT, COMBINED CONCRETE AND SOIL DATA**  
Former Pechiney Cast Plate, Inc., Facility  
Vernon, California

Concentrations in picograms per gram (pg/g)

Aroclor 1260			
General Statistics			
Number of Valid Data	26	Number of Detected Data	17
Number of Distinct Detected Data	17	Number of Non-Detect Data	9
		Percent Non-Detects	34.62%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	26	Minimum Detected	3.258
Maximum Detected	200000	Maximum Detected	12.21
Mean of Detected	13594	Mean of Detected	5.788
SD of Detected	48437	SD of Detected	2.433
Minimum Non-Detect	20	Minimum Non-Detect	2.996
Maximum Non-Detect	100	Maximum Non-Detect	4.605
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	15
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	11
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	57.69%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.314	Shapiro Wilk Test Statistic	0.862
5% Shapiro Wilk Critical Value	0.892	5% Shapiro Wilk Critical Value	0.892
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	8893	Mean	4.643
SD	39306	SD	2.54
95% DL/2 (t) UCL	22060	95% H-Stat (DL/2) UCL	31690
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	
	N/A	SD in Log Scale	
		Mean in Original Scale	
		SD in Original Scale	
		95% t UCL	
		95% Percentile Bootstrap UCL	
		95% BCA Bootstrap UCL	
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.202	Data do not follow a Discernable Distribution (0.05)	
Theta Star	67293		
nu star	6.868		
A-D Test Statistic		Nonparametric Statistics	
5% A-D Critical Value	0.884	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.884	Mean	
5% K-S Critical Value	0.232	SD	
Data not Gamma Distributed at 5% Significance Level		SE of Mean	
		95% KM (t) UCL	
		95% KM (z) UCL	
		95% KM (jackknife) UCL	
		95% KM (bootstrap t) UCL	
		95% KM (BCA) UCL	
		95% KM (Percentile Bootstrap) UCL	
		95% KM (Chebyshev) UCL	
		97.5% KM (Chebyshev) UCL	
		99% KM (Chebyshev) UCL	
Assuming Gamma Distribution		Potential UCLs to Use	
Gamma ROS Statistics using Extrapolated Data		99% KM (Chebyshev) UCL	
Minimum	1.00E-12		86419
Maximum	200000		
Mean	8888		
Median	42		
SD	39307		
k star	0.077		
Theta star	115475		
Nu star	4.002		
AppChi2	0.723		
95% Gamma Approximate UCL	49227		
95% Adjusted Gamma UCL	55644		
Note: DL/2 is not a recommended method.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
For additional insight, the user may want to consult a statistician.			

Appendix C  
(Revised October 2010)

Site-Specific Modeling for the Protection of Groundwater

**Revision Background**

This Appendix was originally submitted to the U.S. Environmental Protection Agency (U.S. EPA) with the 2009 PCB Notification Plan.<sup>1</sup> As part of U.S. EPA's conditional approval of the PCB Notification Plan<sup>2</sup>, U.S. EPA requested Pechiney to revise Appendix C to address the following questions (in *italic*). Responses to these questions are summarized below, and the applicable revisions to the model have been incorporated in this appendix.

1. *Since the mode was run over a period of 500 years and in order to simulate a more conservative worst case, a suggested 250-500 year recurrence interval for rainfall would be more realistic. In addition, short duration, high intensity rainfall events shall be considered. Can the model simulate 24-hour rainfall events such as 100, 250, 500 year 24-hour recurrence intervals that would produce wetting fronts capable of transporting PCBs?*

**Response to the Question 1:**

It would be inappropriate to base the infiltration rate on rainfall with long recurrence intervals such as 250 or 500 years, because it would be unrealistic for rainfall with such recurrence intervals to persist over a period of 500 years. The objective of the site-specific modeling is to evaluate the long-term impacts to groundwater by PCBs in soil and concrete disposed on-site, which requires the use of an infiltration rate that corresponds to long-term average rainfall, instead of extreme events.

In addition, annual rainfall with 250 to 500 year recurrent intervals cannot be estimated, because only 100 years of rainfall data (from 1906 to 2009) are

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<sup>1</sup> AMEC Geomatrix, Inc., 2009a, Polychlorinated Biphenyls Notification Plan, Pechiney Cast Plate Facility, Vernon, California, July 13.

<sup>2</sup> U.S. EPA, 2010, USEPA Conditional Approval for Former Pechiney Cast Plate, Inc., Facility PCB Risk-Based Cleanup Under 40 CFR 761.61(c), July 2.

available at the nearby weather station (Los Angeles Civic Center).<sup>3</sup> Although annual rainfall with a 100-year recurrence interval can be estimated as 34 inches per year, even this estimate contains a fair amount of uncertainty because only 100 years of data are available.

Sufficient conservativeness has been built into the infiltration rate of 4 inches per year used in the site-specific modeling. First, because the final ground surface will be either paved or vegetated and graded to facilitate runoff, the assumed 25 percent of rainfall as infiltration is a conservative assumption. Second, the assumed infiltration rate of 4 inches per year is higher than estimates from other published studies (see Section 2.0 of short duration, high intensity rainfall events, such as 24-hour rainfall with a 100-year recurrence interval, are not expected to substantially impact the downward transport of PCBs through the unsaturated zone. First, during short duration, high intensity rainfall events, infiltration rates would not increase in proportion to rainfall. Most of the rainfall would become runoff because of quick soil saturation near ground surface. In fact, peak runoff during short duration, high intensity rainfall events often drives storm water drainage design. Therefore, infiltration rates during short duration, high intensity rainfall events would not be substantially higher than average infiltration rates. Second, the highest 24-hour rainfall at the nearby weather station between 1906 and 2009 is 5.5 inches, which only translate into a few inches of wetting front movement. Finally, the low mobility of PCBs is mainly a result of their propensity of absorbing to organic matters in the subsurface, as exemplified by their high sorption partition coefficients. For example, a study on a PCB-spill site in Canada concluded that downward flow velocity of dissolved PCBs is likely on the order of millimeters per year (Schwartz et al., 1982).<sup>4</sup> Having higher than average infiltration rates over a handful of days during a 500-year period is not expected to substantially increase the velocity of dissolved PCBs. Therefore, it is unnecessary to simulate extreme rainfall events in the site-specific modeling.

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<sup>3</sup> Western Regional Climate Center, <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca5115>

<sup>4</sup> Schwartz, F.W., J.A. Cherry, and J.R. Roberts, 1982, A case study of a chemical spill: polychlorinated biphenyls (PCBs), 2, Hydrogeological conditions and contaminant migration, Water Resource Research, 18, 535-545.

Nevertheless, to add another level of conservativeness in the site-specific modeling, we revised the infiltration rates so that they consist of five 100-year cycles. Each 100-year cycle is comprised of 99 years with an infiltration rate based on average rainfall (i.e., 4 inches per year) and one year with an infiltration rate based on the rainfall with a 100-year recurrence interval (i.e., 8.5 inches per year). These modifications did not change the results or conclusions of the site-specific modeling.

2. *Have solvents been considered in the mobility and transport of PCBs in soils under both saturated and unsaturated conditions? Can the model factor in the effects of solvents on the mobility of PCBs?*

**Response to Question 2:**

The site-specific modeling does not include effects of solvents, such as chlorinated hydrocarbons, Stoddard solvent, and total petroleum hydrocarbons, on the mobility of PCBs under saturated or unsaturated conditions because of the lack of quantitative relationships between sorption partition coefficients (or solubility) of PCBs and co-solvent concentrations even in state-of-the-art modeling programs such as MODFLOW-SURFACT. Research has shown that sorption of hydrophobic organic chemicals (HOCs) such as PCBs can decrease in the presence of some solvents, but that the co-solvent effects are measurable (observable) only under two conditions, neither of which occurs at the Site:

- a. When the solvents are completely miscible with water; or
- b. When polar, partially miscible organic solvents are present in concentrations on the order of a few percents by volume (free product).

Furthermore, the co-solvents that are neither polar nor completely miscible in water, such as trichloroethene, toluene, and *p*-xylene, have little effect on the sorption of HOCs (Haasbeek, 1994; Rao et al., 1990; Pinal et al., 1990).<sup>5,6,7</sup>

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<sup>5</sup> Haasbeek, J.F., 1994, Effects of Cosolvency in the Fate and Transport of PCBs in Soil, Remediation, Summer.

<sup>6</sup> Rao, P.S.C., L.S. Lee, and R. Pinal, 1990, Cosolvency and Sorption of Hydrophobic Organic Chemicals, Environmental Science & Technology, 24, 647-654.

Because most of the solvent-related chemicals in soil at the Site belong to the group of nonpolar, partially miscible organic solvents and exist at relatively low concentrations (i.e., far less than a few percents by volume), these chemicals are not expected to have a substantial impact on the migration of PCBs from crushed concrete. Therefore, the effects from residual solvents in soil are not considered in the site-specific modeling.

3. *Appendix C shall explain the fate and transport mechanism involved in the migration of PCBs at depth well below 15 feet bgs (below ground surface). PCBs have been detected at 71 feet bgs (e.g., 0.490 mg/kg).*

**Response to Question 3:**

The location where PCBs were detected at a depth of 71.5 feet at a concentration of 0.490 mg/kg was observed at one boring advanced near a former vertical pit that contained a hydraulic ram. The hydraulic ram extended to a depth of 65 feet and steel sheet piling for the vertical pit extended to a depth of 47 feet. In this case, the PCBs detected at depth below 15 feet bgs are believed to be associated with the historical operation of the former hydraulic ram within the pit (proposed soil removal Area 4a in former Building 104). The vertical pit was decommissioned in place in the 1970's by Alcoa. As part of the below grade demolition work, the upper 10 feet of the structure will be removed and the remaining portion of the structure will be capped with concrete. Therefore, this preferential pathway for PCBs to migrate below 15 feet bgs no longer exists.

In addition, PCB-impacted soil is proposed for removal to a depth of 15 feet in Area 4a. Once soil is removed a concrete layer will be placed at the base of the soil excavation prior to backfill.

4. *The revised Appendix C shall indicate the particle size used in the model for the crushed PCB-contaminated concrete proposed for onsite disposal.*

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<sup>7</sup> Pinal, R., P.S.C. Rao, L.S. Lee, and P.V. Cline, 1990, Cosolvency of Partially Miscible Organic Solvents on the Solubility of Hydrophobic Organic Chemicals, 24, 639-647.

#### **Response to Question 4:**

Particle size is not a parameter in the model. In the original model simulations, the hydrogeologic and Van Genuchten's parameter values for sand from the ROSETTA program were used to approximate the properties of crushed concrete. The ROSETTA program uses USDA soil textual classes or percentages of sand, silt, and clay, rather than particle sizes, as input parameters.

Based on the project engineering specifications, the crushed concrete will be well graded with a particle size of 1 ½-inch or ¾-inch. Therefore, the model for crushed concrete was revised to use the hydrogeologic and Van Genuchten's parameter values for gravel (Fayer et al., 1992)<sup>8</sup>. It should be noted that the downward water flux and PCB migration are limited by the least permeable soil types in the unsaturated zone. Therefore, using either gravel or sand properties will not result in a substantial change to simulation results.

Using the gravel instead of sand properties to represent crushed concrete did not change the results and conclusions of the site-specific modeling.

## **1.0 INTRODUCTION**

PCBs in soil and concrete were evaluated for potential impacts to groundwater through the use of numerical modeling. Numerical simulations were performed to simulate the fate and transport of PCBs in a one-dimensional soil column in the vadose zone. The modeling was performed using commercial software, MODFLOW-SURFACT (HydroGeologic, Inc., 2006).<sup>9</sup> The code for this software is based on the most commonly used groundwater modeling software, MODFLOW (Harbaugh et al., 2000),<sup>10</sup> released by the United States Geologic Survey. The MODFLOW-SURFACT code has an additional capability to simulate the moisture migration as well as the fate and transport of chemicals in vadose zone using the Van Genuchten's model. MODFLOW-SURFACT is similar to the one-dimensional vadose zone transport model,

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<sup>8</sup> Fayer, M. J., M. L. Rockhold, and M. D. Campbell, 1992, Hydrologic Modeling of Protective Barriers: Comparison of Field Data and Simulation Results, Soil Science Society of America Journal, 56: 690-700.

<sup>9</sup> HydroGeologic, Inc., 2006, MODFLOW-SURFACT (version 3.0), Reston, Virginia, May.

<sup>10</sup> Harbaugh, A.W., E.R. Banta, M.C. Hill, and M.G. McDonald, 2000, MODFLOW-2000, The U.S. Geological Survey Modular Ground-water Model – User Guide to Modularization Concepts and the Ground-Water Flow Process: U.S. Geological Survey Open-File Report 00-92, p. 121.

VLEACH (Ravi and Johnson, 1994).<sup>11</sup> This code was selected because it is supported by commonly used MODFLOW pre- and post-processing graphical user interface software, Groundwater Vista®, which was released by Environmental Simulation, Inc. (2007).<sup>12</sup>

## **2.0 MODEL CONSTRUCTION AND PARAMETERS**

A one-dimensional MODFLOW-SURFACT model was constructed to simulate a one-dimensional soil column. The model domain consisted of one row and one column. Vertically, the model has thirty layers with a uniform thickness of 5 feet to represent the vadose zone and one layer with a thickness of 50 feet to represent the saturated zone. The groundwater table was assumed to be at 150 feet below ground surface (bgs).

The lithologic profile used in the MODFLOW-SURFACT model was based on the logs of on-site Borings 125 and 126; the lithologic profile developed from these two borings was considered representative of site-wide conditions. The hydrogeologic parameters and Van Genuchten's model parameters for each layer were obtained using the computer code ROSETTA (version 1.2) developed by the Salinity Laboratory of the United States Department of Agriculture (2000).<sup>13</sup> The inputs to the ROSETTA code are the percentage of sand, silt, and clay in each layer. For each boring, the percentages of gravel, sand, silt, and clay in 5-foot intervals between the ground surface and the groundwater table were estimated. The percentage of gravel is combined with the percentage of sand as the ROSETTA does not take percentage of gravel as an input. The percentages in the same interval for the two borings were then averaged to obtain average percentages as input to ROSETTA. In the MODFLOW-SURFACT model for crushed concrete, the hydrogeologic parameters and Van Genuchten's model parameters for gravel were used for the top 15 feet of vadose soil to represent the crushed concrete as fill.

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<sup>11</sup> Ravi, V. and J.A. Johnson, 1994, VLEACH (version 2.1), Center for Subsurface Modeling Support, Robert Kerr Environmental Research Laboratory, Ada, Oklahoma.

<sup>12</sup> Environmental Simulation, Inc., 2007, Groundwater Vista (version 5.01), Reinholds, Pennsylvania, June.

<sup>13</sup> United States Salinity Laboratory, 2000, ROSETTA (version 2.1), Agricultural Research Service, United States Department of Agriculture, November.

The other model parameters are listed below.

- Soil bulk density,  $\rho = 96$  pounds per cubic feet
- Porosity,  $n = 0.40$
- Soil organic carbon content,  $f_{oc} = 0.39\%$
- Sorption partition coefficient for PCBs,  $K_{oc} = 309,000$  liters per kilogram

Site-specific soil physical properties were based on the field investigations of the Morrison Knudsen Corporation (1995).<sup>14</sup> The effective porosity value in the model is assumed to be 40 percent, based on an average porosity value of 47 percent. The sorption partition coefficient for PCBs was obtained from U.S. EPA guidance (1996).<sup>15</sup> The dispersivity in the model is assumed to be equal to 15 feet, 10 percent of the simulated distance between PCB source and groundwater table (150 feet).

Infiltration was applied to the uppermost model layer. Different infiltration rates were assumed for stress periods of 11 years or one year in length.<sup>16</sup> An average infiltration rate of four inches per year was assumed for each 11-year stress period, which is approximately 25 percent of the average annual precipitation at the Los Angeles Civic Center weather station (the nearest Western Regional Climate Center Station to the city of Vernon) from 1906 to 2010 (14.7 inches per year).<sup>17</sup> Four inches per year of infiltration is considered conservative for a largely paved or vegetated land surface. As a reference, if the infiltration rate is calculated using the recharge model of Williamson et al., 1989,<sup>18</sup>

$$R = \max[(0.64 \times P - 9.1), 0]$$

where, R = infiltration rate (inches/year)

P = precipitation (inches/year)

<sup>14</sup> Morrison Knudsen Corporation, 1995, Final Report Stoddard Solvent System Field Investigation, Aluminum Company of America, October 27.

<sup>15</sup> U.S. EPA, 1996, Soil Screening Guidance: Users Guide and Technical Background Document, Office of Solid Waste and Emergency Response, Washington, D.C., EPA/540/R-95/128, May.

<sup>16</sup> The model was set up to run in transient mode for a 500-year period, divided into five 100-year cycles, with each cycle consisting of nine 11-year stress periods with average precipitation (divided into 132 monthly time steps) and one 1-year stress period with 100-year recurrence interval precipitation (divided into 12 monthly time steps).

<sup>17</sup> Western Regional Climate Center, <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca5115>

<sup>18</sup> Williamson, A.K., D.E. Prudic, and L.A. Swain, 1989, Ground-water flow in the Central Valley, California, U.S. Geological Survey Professional Paper 1401-D.

the infiltration rate is approximately 0.4 inches per year. A study on infiltration rates in the Riverside County, which has similar meteorological condition as the site, by USGS also suggested that the land surface infiltration rate is much less than 25% of precipitation.<sup>19</sup> Therefore, the infiltration rate of four inches per year is a conservative assumption, even for an unpaved land surface. For each one-year stress period, an infiltration rate of 8.5 inches per year was assumed, which is approximately 25 percent of the highest recorded annual precipitation from the Los Angeles Civic Center weather station from 1906 to 2010 (34.0 inches per year).<sup>18</sup>

A constant head boundary with the specified head equal to the elevation of the top of the bottom layer was applied at the bottom layer to represent the groundwater table elevation in the saturated zone.

### **3.0 SIMULATIONS**

Two separate simulations, one for PCBs in soil and another for PCBs in concrete (assumed to be crushed and re-used as fill on-site), were conducted to determine if the detected concentrations in either medium pose a threat to groundwater quality. Specifically, the simulations were used to estimate site-specific attenuation factors for PCBs, which were then used in reverse calculations from the groundwater maximum contaminant level (MCL) to determine the concentrations that would be necessary in the vadose zone to pose a potential threat to groundwater.

#### **3.1 PCBs IN SOIL**

The MODFLOW-SURFACT model described above was used to estimate site-specific attenuation factors for PCBs in soil at hypothetical source depths of 15 feet, 30 feet, and 45 feet bgs. These attenuation factors were estimated by having the MODFLOW-SURFACT model simulate the movement of PCBs in pore water from these depths to pore water immediately above the water table (at approximately 150 feet bgs) after 500 years. A constant PCB concentration in pore water of 100 micrograms per liter ( $\mu\text{g/L}$ ) was assumed at each source depth for the simulations. The attenuation factors were then calculated as the ratios of the source pore water concentration (100  $\mu\text{g/L}$ ) to

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<sup>19</sup> USGS, Rainfall-Runoff Characteristics and Effects of Increased Urban Density on Streamflow and Infiltration in Eastern Part of the San Jacinto River Basin, Riverside County, California, USGS Water-Resources Investigations Report 02-4090.

the simulated pore water concentrations immediately above the water table. All calculations using the MODFLOW-SURFACT simulation results were implemented in Mathcad® (version 14; Parametric Technology Corporation, 2007) (Worksheet C-1).

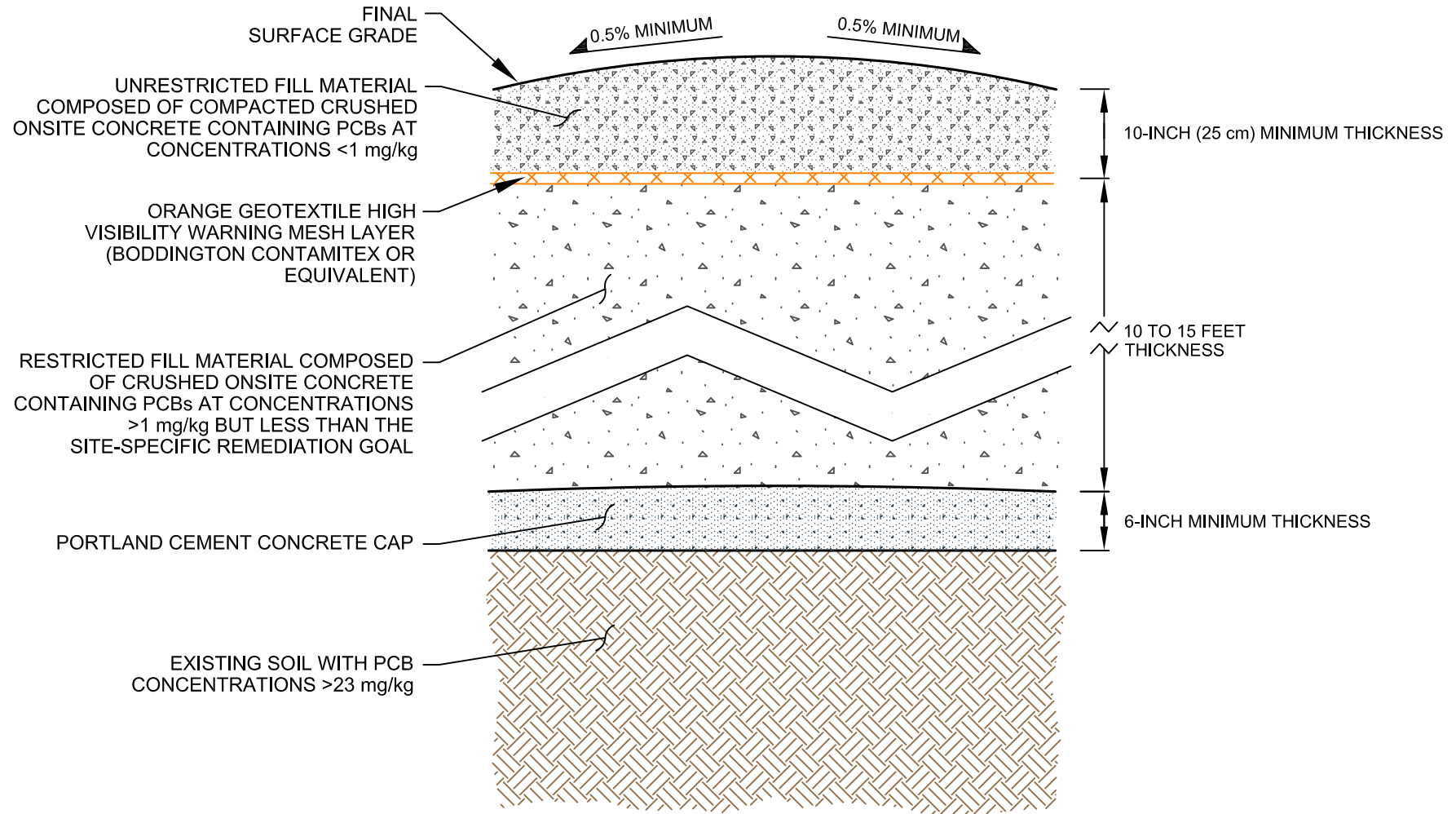
For the hypothetical source depths of 15 and 30 feet bgs, the simulated pore water concentrations immediately above the water table were below the lowest value that the MODFLOW-SURFACT could report ( $1 \times 10^{-44}$  µg/L). The minimum reportable concentration ( $1 \times 10^{-44}$  µg/L) was therefore used as the simulated pore water concentration immediately above the water table in calculating the attenuation factors for these two cases. As the pore water concentrations immediately above the water table would actually be lower than this minimum reportable value, the simulated attenuation is actually higher than the results would indicate.

As presented in Worksheet C-1, the attenuation factors calculated with this method ranged from  $2.2 \times 10^{44}$  to  $1 \times 10^{46}$  for source depths of 15 to 45 feet bgs. These attenuation factors are conservative because the dilution of PCBs after entering the saturated zone and the degradation of PCBs in the vadose zone are not considered in the MODFLOW-SURFACT model. These attenuation factors were then used in a reverse calculation from the MCL, 0.5 µg/L, to estimate the source pore water concentrations at 15 feet, 30 feet, and 45 feet bgs that would be necessary to pose a potential threat to groundwater quality. The estimated source pore water concentrations ranged from  $1.1 \times 10^{41}$  to  $5 \times 10^{42}$  milligrams per liter (mg/L) (Worksheet C-1). Based on these calculations, the concentration of PCBs in source pore water at the Site would need to exceed  $1.1 \times 10^{41}$  mg/L at 45 feet bgs or  $5 \times 10^{42}$  mg/L at 15 to 30 feet bgs to result in groundwater concentrations exceeding the MCL. Because these concentrations greatly exceed the solubility limit of PCBs in water (0.7 mg/L; U.S. EPA, 1996)<sup>15</sup> and exceeds the concentration of pure phase PCBs ( $1 \times 10^6$  mg/L), it is physically impossible to achieve PCB concentrations in the source pore water that would result in a concentration of PCBs exceeding the MCL in groundwater. Therefore, PCBs in soil at the Site do not pose a potential threat to groundwater at the Site.

### **3.2 PCBs IN CRUSHED CONCRETE**

Because crushed concrete containing PCBs may be re-used as on-site fill materials within the upper 15 feet of the vadose zone, the reverse calculation method described above was also used to verify that PCBs in re-used crushed concrete do not pose a potential threat to groundwater quality. The MODFLOW-SURFACT simulation was performed in the same manner as described above for soil, but modified to account for the physical properties associated with crushed concrete. For crushed concrete, the hydrogeologic parameters and Van Genuchten's model parameters for gravel (Fayer et al., 1992)<sup>8</sup> were used rather than the lithologic parameters estimated for the upper 15 feet of the soil column. An attenuation factor was then estimated for PCBs from a source depth of 15 feet bgs, corresponding to the bottom depth of proposed concrete re-use. As presented in Worksheet C-2, the attenuation factor estimated for the concrete re-use scenario was  $1 \times 10^{46}$ , equal to the attenuation factor estimated for PCBs in native soil at 15 or 30 feet bgs (Worksheet C-1). Correspondingly, the source pore water concentration of PCBs dissolved from crushed concrete at 15 feet bgs would need to exceed  $5 \times 10^{42}$  mg/L to result in groundwater concentrations exceeding the MCL. As noted earlier for soil, these concentrations greatly exceed the solubility limit of PCBs in water (0.7 mg/L; U.S. EPA, 1996) and exceed the concentration of pure phase PCBs ( $1 \times 10^6$  mg/L), and therefore it is physically impossible to achieve PCB concentrations in the source pore water from the crushed concrete that would result in a concentration of PCBs exceeding the MCL in groundwater. Therefore, PCBs in concrete that may be re-used (on-site disposal) as on-site fill materials also do not pose a potential threat to groundwater at the Site.

The changes made to the model for addressing the U.S. EPA's questions did not change the results and conclusions of the site-specific modeling.



#### NOTES:

1. CRUSHED ONSITE CONCRETE SHALL BE COMPACTED TO A MINIMUM OF 90 PERCENT AS DETERMINED BY THE LATEST EDITION OF ASTM 01557 (MODIFIED PROCTOR TEST).
2. ONSITE CONCRETE SHALL BE CRUSHED AND GRADED TO CONFORM WITH GREEN BOOK 200-2.4 SPECIFICATIONS.
3. mg/kg = MILLIGRAMS PER KILOGRAM.
4. EXISTING SOIL WITH PCB CONCENTRATIONS >23 mg/kg IN THE 4a/4b AREA WILL BE APPROXIMATELY 15 FEET BELOW GROUND SURFACE.

Vertical Dimensions Not To Scale

CONCEPTUAL INTERIM CAP  
OVER THE 4a AND 4b EXCAVATION AREAS  
Former Pechiney Cast Plate, Inc. Facility  
3200 Fruitland Avenue  
Vernon, California

By: jrw	Date: 12/9/10	Project No. 010627.003
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**AMEC Geomatrix**

Figure **9**